ELECTRICAL WORLD

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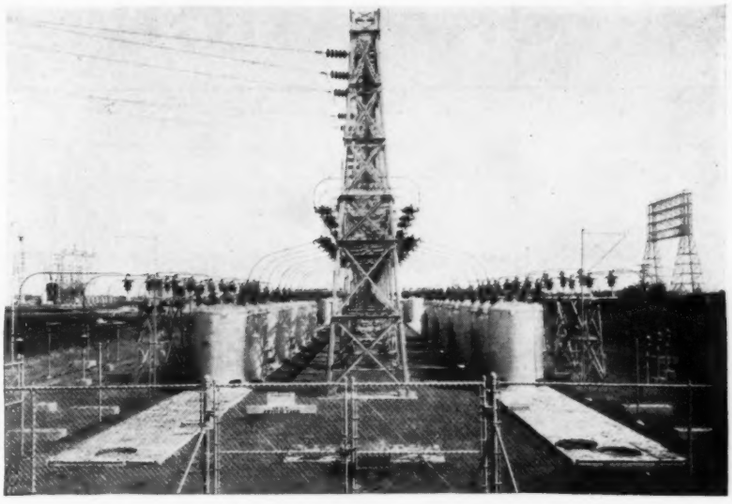

66-kv. substation, Southern California Edison Company

DECEMBER 20, 1930

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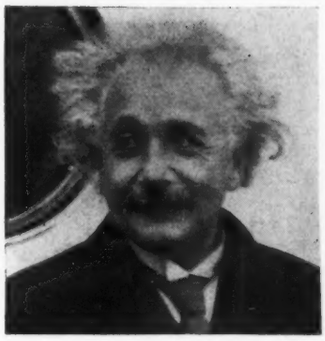
ELECTRICAL WORLD

for the Week Ending

December 20, 1930



It would take me three days to give a short definition of relativity.

I have received such an insuperable impression of the life rhythm of the present American man on my reception by the journalists and photographers in New York that it would be impossible to exceed it by any adventure ever so eccentric. The time interval of seven years of the Bible has been changed to 30 minutes. This ratio is approximately proportional to the rhythm of life of my forefather and the one of a typical American today.

ALBERT EINSTEIN,
Mathematician, Physicist.

Senate committee approves nominees to Power Commission

Los Angeles seeks distribution outlet for Hoover Dam power

—**Bonner to leave commission** as result of "unwarranted attacks"? In midst of turmoil over Hoover's power board nominations, commission's executive secretary is assailed by Wheeler of Montana and expresses resentment—*p. 1112.*

—**A.I.E.E. 1931 nominations out.** Charles E. Skinner of the Westinghouse company destined, according to all precedent, to be president beginning August 1—*p. 1114.*

—**Cable fabrication is improved** by super-vacuum process to reduce ionization. Compound treating and insulation drying is done at 1-mm. absolute pressure. Improves performance—*p. 1132.*

—**Clarion River case continues** with Solicitor Russell of Power Commission accusing Pennsylvania Public Service Commission of countenancing six-million-dollar "flimflam" of the people—*p. 1113.*

—**Energy losses heat substation.** 300-kw. heat loss from 15,000-kw. synchronous condenser used to warm separate office and control building of Ohio utility. Another case of planned economies—*p. 1131.*

—**Los Angeles may buy utility.** Once again, having had such ideas before, the Board of Water and Power Commissioners passes a resolution and appoints committee to negotiate. Outlet sought for Hoover Dam power—*p. 1116.*

—**Interconnections saved hydro** in the drought of 1930. Value of heavy transmission ties and reserve steam capacity proved by experience in successfully beating the long, dry summer—*p. 1122.*

—**Better watt-hour meters here.** Continued development work yields equipment with greatly improved accuracy under all conditions. Temperature compensation an important factor—*p. 1127.*

NEWS OF THE WEEK

Federal Power Commission Nominees All Indorsed by Committee

CONFIRMATION of four of the five appointments to the new Federal Power Commission made by President Hoover seems reasonably certain as this issue goes to press, the one most in doubt being that of Frank R. McNinch of North Carolina.

Dr. George Otis Smith, now director of the United States Geological Survey, nominated to be chairman of the commission, was subjected by the interstate commerce committee of the Senate to an extended examination as to his views concerning the principal controverted questions which have arisen in the administration of the water-power act. Dr. Smith expressed his views freely but declined to make any pledges or promises. He frankly expressed his conviction that private operation of water-power projects is to be desired over public operation. He made clear, however, his realization that it is the intent of the water-power act to give preference to states and municipalities applying for rights and that he would therefore vote for the public project when it is in a position to make comparable use of the resource.

Dr. Smith declined to express approval or disapproval of the Attorney-General's opinion in the New River case. He said he had had no opportunity to study the facts involved, but that as a general proposition he favored state regulation. In cases where regulation is not accomplished by the state, the federal government would have to fill the gap. In so far as interstate transmission of power is concerned, Dr. Smith asserted his belief that it can be regulated successfully with full recognition of both state and federal authority. Engineering facts, he said, tend to disregard state lines; but he made it clear that he does not think state regulation is breaking down.

Senator Wheeler of Montana examined Dr. Smith at length in regard to several open letters which he wrote as a citizen of Maine during the campaign in that state to decide whether or not it should prohibit the export of hydro-electric power. Senator Wheeler took the ground that Dr. Smith had sided with the power company in opposing the non-exportation law. He was the only member of the committee to vote against a favorable report on the nomination.

Only perfunctory questions were asked of Claude L. Draper of Wyoming and Ralph B. Williamson of Oregon. Frank R. McNinch of North Carolina and Marcel Garsand of Louisiana had no such clear sailing. The opposition to Mr. McNinch, nominated as a minority-party member, came largely from regular Democrats and was based on his support of Republican candidates in recent campaigns. The insurgent element on the committee took kindly to him, however, and on Wednesday his nomination was indorsed by ten to five.

The opposition to Mr. Garsaud came from his own state, Louisiana. At the request of Governor Huey F. Long three witnesses from that commonwealth appeared in an effort to establish that Mr. Garsaud would be inclined to favor power companies because of past employment by members of the board of directors of the utility company operating in New Orleans. Senators Wheeler, Dill, Brookhart and Howell voted against him in committee.

The fight over McNinch, Garsaud and Smith will be carried to the floor of the Senate, which will probably defer consideration of the nominations until after the holidays.

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Bonner Indicates a Desire for Transfer

INDIGNANT OVER ATTACKS made on him by United States senators because of his alleged subserviency to what they term the "power trust," Frank E. Bonner, executive secretary of the Federal

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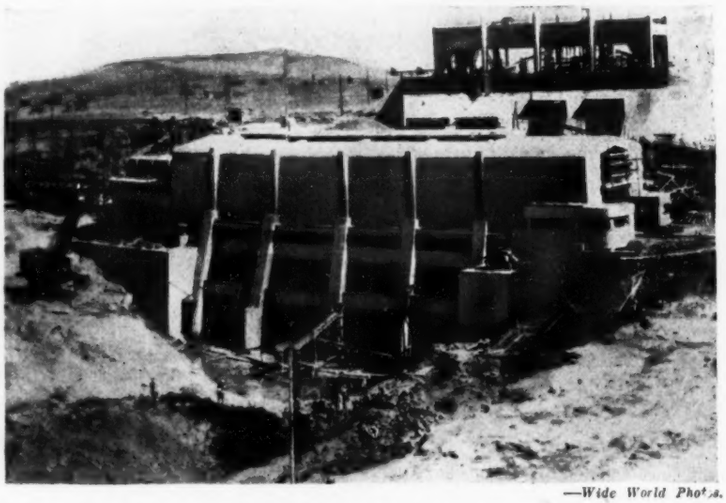
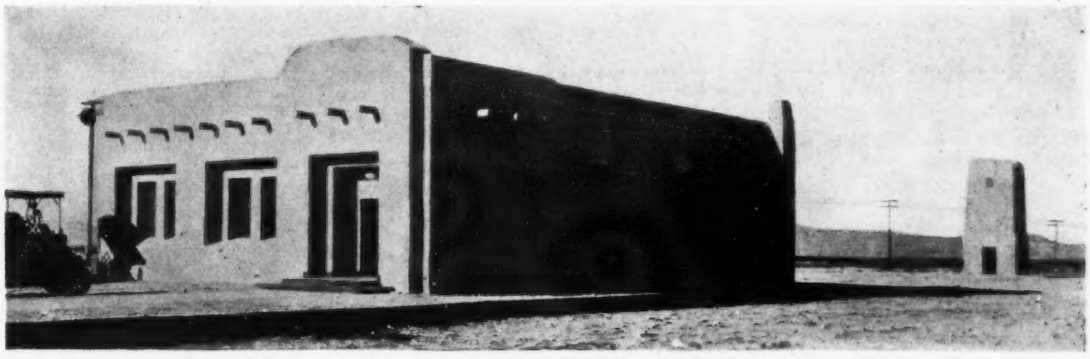
EASTWARD THE STAR OF ELECTRICITY—



—*Wide World Photo.*

Slowly rising on the banks of the River Jordan, the 24,000-hp. generating station that is to bring modern light and power to ancient Palestine now dominates the view.

LAS VEGAS, NEVADA'S BOOM TOWN, STARTS IN ELECTRICALLY



Las Vegas, embryo metropolis and headquarters for Hoover Dam construction, is naturally up with the times. The new toll building of the Bell Telephone Company there is the product of electric arc welding. The 30-ft. water tower at the right is fabricated entirely of arc-welded steel, including the 3,000-gal. tank.

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Power Commission, has sent a letter to Senator Couzens in which he says, after referring to Senator Wheeler's alleged attitude and to reports that a pledge for the executive secretary's removal might be exacted from nominees to the new commission as an "outrageous proceeding" and "arrogant presumption":

Senator Wheeler knows perfectly well that I am serving in the civil service of the United States and that the regular channels for any complaint against my official actions are open to him. Irresponsible criticism from time to time that either myself or the commission has been influenced by the so-called "power trust" is absolutely unwarranted and with no foundation in truth or fact.

With all due respect, I wish to vigorously protest this treatment at the hands of the committee and to advise Senator Wheeler that he need have no worry about my future service with the Federal Power Commission. I have no inclination whatever to be connected with an activity that is becoming a political football.

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Ainey Seeks Apology from Solicitor Russell

A MOTION TO DISMISS the suit instituted by the Clarion River Power Company against the Federal Power Commission to enjoin the latter from acting on the investment costs of the Piney hydro-electric development was argued for the commission before the District of Columbia Supreme Court on December 8, ten days being allowed the company in which to file a reply.

The Clarion River company will contend that, under the water-power law, a licensee is required simply to file its statement with the Secretary of the Treasury and that the determination of the net investment may not be required for 20 years, at the earliest, and really is not required for 50 years. The intent of the water-power act, it is claimed, is that the question of net investment shall be determined by the courts and not by the commission.

In the course of his argument Charles A. Russell, solicitor for the Federal Power Commission, attacked the Pennsylvania Public Service Commission violently, saying that it had "deliberately misconstrued the state law" and stood by "in innocuous desuetude while the Clarion company flimflammed the people of Pennsylvania out of more than $6,000,000."

W. D. B. Ainey, chairman of the Pennsylvania commission, at once registered a formal protest with the Federal Power Commission, demanding that Solicitor Russell either substantiate his statements or retract them with apology. Mr. Ainey maintains that the Pennsylvania Public Service Commission has no jurisdiction over security issues and centers its attention on rates; that in this case it co-operated with the Federal Power Commission in a detailed audit of the Clarion River Power Company's books, and that that company sells its entire product to distributing companies at a flat base rate of 7 mills a kilowatt-hour, bringing it an average return of 7 per cent.

Acting Chairman Wilbur of the federal body called upon Mr. Russell for an explanation of his reflections on the Pennsylvania commission. Mr. Russell replied in a long memorandum in which, after premising that "no government official should be called upon to explain newspaper comments which are in nowise official," he goes on to maintain his contentions that the Pennsylvania commission has authority to regulate security issues, that it has neglected to do so, and that it did not properly co-operate with the Federal Power Commission in the Clarion River case. He also declares that the voters of Pennsylvania repudiated the state commission in the November elections.

Governor-elect Pinchot of Pennsylvania, who declares that unless the federal government controls hydro-electric development, protects the public which invests in power securities and regulates interstate rates, the "power trust" will be a big issue in 1932, sides with Mr. Russell, maintaining that the Pennsylvania commission has definite power under the law to regulate security issues but lacks the will to do so.

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Muscle Shoals Conferees Consider New Proposal

FOLLOWING A PREVIOUS CONCESSION permitting government operation of the power plant at Muscle Shoals itself, a new compromise offer made on December 12 by the House conferees on that subject to their senatorial confrères was embodied in the following proposal:

"That the government lease the nitrate plants, making liberal provision for the manufacture of fertilizer, fertilizer ingredients and kindred chemical and electrochemical products useful in national defense, with provision in the lease contract or contracts for ample power at such price and terms as will encourage quantity production of cheap fertilizer under strict provisions for the benefit of agriculture."

The conferees were far from agreement as the ELECTRICAL WORLD went to press, and their report is not likely to be submitted before the first of the year.

Secretary of War Hurley has reported to the Senate that a new contract became effective December 1 for

three months under which the Alabama Power Company pays $10,000 a month for Muscle Shoals energy. The company wanted to enter an agreement under which it would pay $1,500 a month for the power plus $800 for every day the power plant was in operation. The Secretary refused this agreement on the ground that he did not want to make any change during the short session of Congress. However, if Congress does not dispose of Muscle Shoals by March 1, 1931, the Secretary said he was going to enter an agreement with the company along the lines sought by it.

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Mercury Boiler Gains Fresh Commendation

SPEAKING TO THE CONNECTICUT SECTION of the A.I.E.E. at Hartford on Monday, Vice-President T. H. Soren of the Hartford Electric Light Company said that between February 4 and December 14 the mercury-boiler unit at South Meadow had produced 112,238,940 kw.-hr. at an average rate of 10,310 B.t.u. The unit was available for service 82.3 per cent of the time allowing for all causes of shutdown and 95.1 per cent of the time deducting mercury causes only. Irving E. Moultrop, chief engineer of the Boston Edison company, who shared the platform with Mr. Soren, expressed his confidence in the future of the mercury process provided that costs of construction and installation allow its more general use.

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Charles E. Skinner Heads 1931 Institute Ticket

NOMINATION OF Charles E. Skinner for president of the American Institute of Electrical Engineers in the society year beginning August 1, 1931, has just been announced by the national nominating committee of the Institute, consisting of fifteen members from various parts of the country. Mr. Skinner is the assistant director of engineering for the Westinghouse Electric & Manufacturing Company and has been prominent in the technical branch of the industry for many years. A biographical sketch of him, with a portrait, is printed on page 1145.

The remainder of the official ticket, which will, as usual, be voted on, together with any independent nominees, by mail next spring, is as follows:

For Vice-Presidents:

Middle Eastern District: W. B. Kouwenhoven, professor of electrical engineering, assistant dean of the Engineering School, Johns Hopkins University, Baltimore.

Southern District: W. E. Freeman, assistant dean College of Engineering, head department of electrical engineering, University of Kentucky, Lexington.

North Central District: Paul H. Patton, telephone engineer, Northwestern Bell Telephone Company, Omaha.

Pacific District: A. W. Copley, engineering manager Pacific Coast district Westinghouse Electric & Manufacturing Company, San Francisco.

Canada District: L. B. Chubbuck, switching equipment engineer, Canadian Westinghouse Company, Ltd., Hamilton, Ont.

For Directors:

L. W. Chubb, director Westinghouse research laboratories, East Pittsburgh, Pa.

B. D. Hull, engineer Southwestern Bell Telephone Company, Dallas.

H. R. Woodrow, electrical engineer Brooklyn Edison Company.

For National Treasurer:

W. I. Slichter, professor of electrical engineering, Columbia University, New York.

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New York Merchants Oppose Public Ownership

PRIVATE DEVELOPMENT of water power, as opposed to development by either the nation or the states, is favored by the Merchants' Association of New York City, which has indorsed the recommendations made by the Chamber of Commerce as printed in the ELECTRICAL WORLD for November 15 (page 897). The association favors the sale or lease of the government's property at Muscle Shoals and recommends that the federal government leave the construction of dams and other structures and the generation of power to others, except in instances where such developments "are an essential part of national or international projects that cannot be carried out successfully by other agencies." State governments, the association holds, "should leave development and distribution of power to utilities which they effectively regulate."

Trade Board on Interstate Transmission

A SIGNIFICANT paragraph is contained in the interim report of the Federal Trade Commission made to the United States Senate under date of Saturday, December 20. It is to the effect that because of technological development the United States is in effect becoming smaller, leading to the disregard of state lines in the supply of electricity. Electrical energy, the commission says, is moving across state and national boundaries in rapidly increasing volume, and conditions point to future expansion in long-distance transmission and increasing disregard of the boundaries between the commonwealths.

RADIO ENGINEER GETS EDISON MEDAL

Dr. Frank Conrad, Westinghouse radio engineer, who has just been named as next recipient of this award, is here shown hard at work. *(See page 1145.)*

▼

Saluda River Plant in Full Operation

THE FIRST COMMERCIAL POWER from the Saluda Dam station of the Lexington Water Power Company, now a part of the Associated Gas & Electric System, was recently delivered. This power went into the system of the Duke Power Company, which has contracted to purchase a block of the energy generated and has high-tension transmission lines running to the station. The output increased steadily until the first of this week, when full operation began and the contract with the Carolina Power & Light Company went into effect. The four units at Saluda Dam are now all available for service and are each capable of delivering 55,650 hp.

The Broad River Power Company, also a part of the Associated Gas & Electric System; the Carolina Power & Light Company and the Duke Power Company are the three operating companies that will take the output of the plant.

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Ontario Liberals Indorse Joint St. Lawrence Work

RESOLUTIONS WERE ADOPTED at a convention of the Liberal party of Ontario held in Toronto on December 16 indorsing the St. Lawrence canal and power scheme as a joint international project of Canada and the United States and urging its immediate furtherance.

Rate Reductions Made—Others Are in Dispute

A RATE REDUCTION amounting to $500,000 annually has just been made by the Connecticut Light & Power Company, which has 146,000 customers in Waterbury, New Britain, Meriden, Plainfield, Naugatuck, Norwalk, Branford, Greenwich, Watertown, Bristol, Putnam, Plainville and many other places. Residence customers now paying 5 cents will receive a 20 per cent reduction on all energy exceeding 20 kw. a month, making second-step rate 4 cents.

The Dayton (Ohio) Power & Light Company will reduce its power rate 9.46 per cent, beginning January 1. The reduction will bring an annual saving of approximately $220,000 to consumers on the basis of present consumption. At Xenia a new schedule provides a reduction of 11¾ per cent to the smallest consumers, and the average reduction to all residential consumers is estimated at 11½ per cent a year.

The New York Public Service Commission announced on December 10 that the village of Penn Yan in Yates County, which operates a municipal power plant, purposes to give all its 1,770 consumers of electricity a Christmas present of the energy used in December. This gift follows closely upon a substantial reduction in electric rates.

The Pacific Gas & Electric Company has filed answers with the California Railroad Commission to the complaints of the Modesto Irrigation District and the city of Oakland, in which it is alleged that the utility has placed unduly low rates for electric service in effect in its Modesto area. The company denies that it discriminates against Oakland and says that the rates in the Modesto area were placed in effect upon authority of the commission for the purpose of meeting the competition of the Modesto Irrigation District's electric plant, which had taken approximately 75 per cent of the electric business in the district away from the company by low competitive tariff.

Charging confiscation in the amount of $2,000,000 a year, a petition has been filed with the California Railroad Commission by the Los Angeles Gas & Electric Corporation asking a rehearing on the commission's recent order which reduced the rates of the power company approximately $1,350,000 for gas service, made permanent the temporary electric rates heretofore fixed by the commission for that company and continued in effect reductions of approximately $750,000 a year for energy.

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Carpenter Dam Right up to Schedule Time

ALL THE CONCRETE for the Carpenter hydro-electric development on the Ouachita River, near Hot Springs, Ark., which is being built for the Arkansas Power & Light Company, has been poured, and construction work is exactly on schedule. Turbines are now being installed and the plant will be complete in July. There will be two 37,000-hp. generators, with provision for a third. The dam is 115 ft. high and 1,165 ft. long at the top.

Carpenter Dam is 10 miles above the existing Remmel Dam. Eventually a third dam will be built at Blanco Springs, involving a 70-mile reservoir and a total installation of 200,000 hp. for the three plants.

P. S. of New Jersey May Condemn Property

SETTING ASIDE THE CONTENTION of certain property owners in New Jersey that the Public Service Electric & Gas Company has no legal right to condemn property on which to build a power line for "interstate commerce exclusively," the New Jersey Board of Public Service Commissioners has granted permission to that company to acquire a right-of-way by condemnation in order to connect its system with those of the Pennsylvania Power & Light and the Philadelphia Electric companies. Since the New Jersey company would receive energy for distribution in its own territory over the interconnection as well as transmit energy to the other companies concerned, the board declared that the transaction was not one of interstate commerce only. The operating benefit of the interconnection based on diversity of peak loads was accepted by the commission as fully justifying the building of the lines.

▼

New Washington Rates Still Await Adjustment

DEMAND FOR A PUBLIC HEARING, put forth by People's Counsel Richmond B. Keech and others, in the matter of the new rates of the Potomac Electric Power Company has led the Public Utilities Commission of the District of Columbia to announce that one will be held before the rates for 1931 are promulgated.

The company had proposed and the commission had tentatively accepted a group of schedules calling for reduc-

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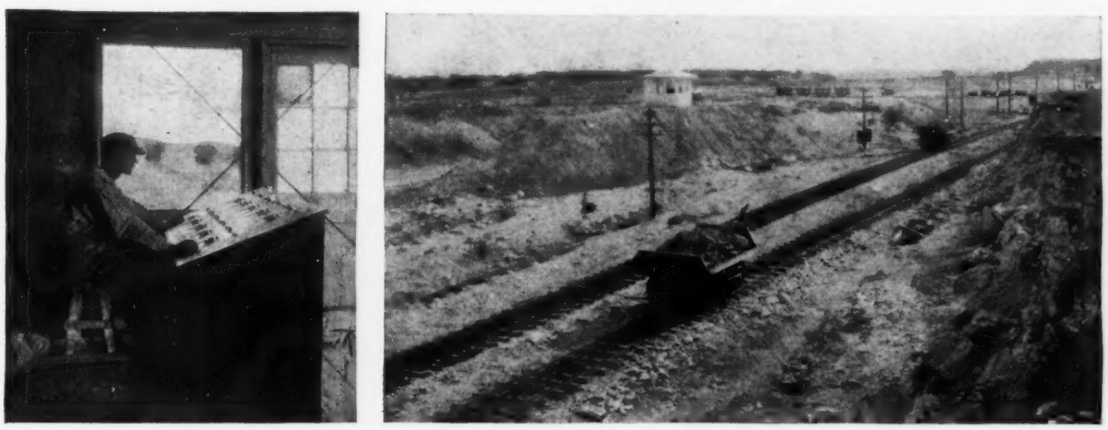
RIDERLESS CARS CARRY COAL FROM QUARRY TO MILL



By remote control larry cars, each equipped with two 50-hp. squirrel-cage G.E. motors, convey cement rock from the excavating pit of the Trinity Portland Cement Company, Dallas, Tex., to the crusher, full cars passing empty ones. Distribution transformers and central cabinets are installed along the track. The dispatcher sits in the crusher house.

tions in the primary rate from 4.7 cents to 4.2 cents per kilowatt-hour, with accompanying reductions in the various secondary rates. Mr. Keech claims that, owing to the reasonably expected increase of business, the reduction offered by the company not only would fail to decrease its profits but would actually increase them. (ELECTRICAL WORLD, November 29, page 981.)

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Indiana Legislature for Sworn Holding-Firm Data

A BILL TO EXTEND THE POWER of the Indiana Public Service Commission will be introduced in the General Assembly of that state when it convenes in January by C. Y. Foster of Noblesville, who in two campaigns and during the 1929 session of the Legislature advocated the repeal of the public service law, maintaining that public utilities should not be allowed percentage returns on their investment with the exclusion of competition unless the same rule be applied to farmers, factory owners and others.

Mr. Foster's new bill will be an effort to get at the situation in another manner. The measure would require holding companies to make an itemized statement of expenses under oath. He says the commission cannot obtain this information under the present law and contends that if such information were available the commission would be better able to determine rates.

▼

Coming Meetings

American Engineering Council — Annual meeting, Washington, D. C., Jan. 15-17. L. W. Wallace, 26 Jackson Place, Washington.

National Electrical Manufacturers' Association — Midwinter meeting, New York headquarters, Jan. 19-23. A. W. Berresford, 420 Lexington Ave., New York.

American Institute of Electrical Engineers — Winter convention, New York, Jan. 26-30; district meeting, Pittsburgh, March 9-13. F. L. Hutchinson, 33 W. 39th St., New York.

North Central Division, N.E.L.A.— Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, Minneapolis, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

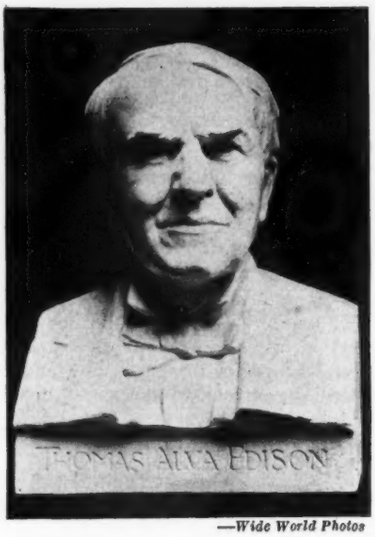
Pacific Coast Electrical Association— Commercial Section, Los Angeles, Feb. 5-6. S. H. Taylor, 447 Sutter St., San Francisco.

Midwest Power Engineering Conference—Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association — Springfield, Ill., March 12 and 13. G. W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

BUST OF EDISON FOR MUNICH MUSEUM



—*Wide World Photos*

Mr. Edison recently posed in Florida for this bust by Evelyn B. Longman Batchelder, which the A.I.E.E. and the Edison Pioneers are jointly presenting to the Deutsches Museum, Munich, Germany.

▼

Decision Due Soon on Santiam River Projects

IT WAS BROUGHT OUT at a recent final hearing before the Oregon Reclamation Commission that the Northwest Power Company, a subsidiary of the Portland General Electric Company, desires to establish additional generating plants on the North Santiam River and Marion Lake, approximately 116 miles south of the utility's present plants, in order to equalize the industrial and domestic power load between the two points and thus insure more adequate service, at possibly a lower cost to consumers, in the field bounded by Salem on the south and Vancouver on the north. It developed at the hearing that the city of Salem, in urging a prompt decision, seeks to avoid being included in any water and power utilities district which may later be created under the recently adopted constitutional amendment, desiring instead the right to use these waters solely as a municipal undertaking. Some agitation exists in the city, also, to expropriate private utility property there and in nearby cities.

Although the Governor, as chairman of the board, voiced the opinion that the city should be granted priority rights, a majority of the members disagreed on the ground that the municipality had failed to establish a legal claim and that there has been no conclusive evidence that the public will be adversely affected by granting the application of the Northwest Power Company. Decision awaits the transcript of the final evidence. (ELECTRICAL WORLD, August 23, page 337.)

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Los Angeles May Buy G. & E. Corporation

PURCHASE BY LOS ANGELES of the entire electrical production and distribution system of the Los Angeles Gas & Electric Corporation was advocated December 9 by the Board of Water and Power Commissioners of that city. A resolution was adopted saying that it was deemed advisable for the city to have an outlet for the use of large quantities of electricity to be generated at Hoover Dam in order that it may be in a position to comply with its contract with the federal government for Hoover Dam power.

A committee of three board members will be appointed to negotiate with the Los Angeles Gas & Electric, and should the negotiations be successful, consideration will be given to a plan to purchase the system on the installment plan from earnings of the power bureau. The terms arrived at by the board and the City Council would be submitted to the voters, who in November defeated a bond issue for expansion of the municipal plant.

Addison B. Day, president of the Los Angeles Gas & Electric Corporation, said his company had entered into no negotiations pertaining to the proposed purchase. The offer was unexpected, he said, although the Board of Water and Power Commissioners has passed similar resolutions in the past.

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New Storage Reservoir for Black River Basin?

STATE ACTION for the immediate construction of a Panther Mountain Reservoir, near Watertown, N. Y., is being agitated in that city, where the recent drought has brought the matter to the fore. The Stillwater Reservoir, with its capacity of 4,500,000,000 cu.ft. of water, has been filled twice this season, but now contains less than 20 per cent of capacity. Manufacturing plants on the Black River have suffered in consequence.

The Panther Mountain Reservoir, on the Moose River, a tributary of the Black, would have an estimated capacity of 14,500,000,000 cu.ft. If constructed, it will ultimately mean the development of new power sites and

will increase the capacity of the Watertown municipal power plant. It is urged also that its construction would help the unemployment situation.

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Customer-Bought Lines Become Utility Property

THAT SERVICE EXTENSIONS paid for by consumers when the prospective revenue would not be sufficient to allow the utility to profit by the extensions are the property of the public utility companies and may be included in the valuation for rate making or for issuance of securities was the ruling of the Dane County (Wis.) Circuit Court in an opinion delivered December 4 sustaining the Wisconsin Hydro-Electric Company against the Wisconsin Railroad Commission. The commission called the decision one of the most far-reaching in the history of Wisconsin public utility regulation and is expected to appeal.

When the Wisconsin Hydro-Electric Company applied to the commission early this year for permission to issue new stock, it asked to have extensions included in the valuation. This the commission refused to allow. The hydro-electric company was seeking to to take over two small properties. The commission found a value of $80,000 for the combined properties, of which $12,035 was paid for by consumers. The commission refused to allow this sum to be included.

Eighth Generator Starts at Huntley Station

AN 80,000-KW. TURBO-GENERATOR, the largest in the Niagara-Hudson system, went into operation at the Charles R. Huntley steam station of the Buffalo General Electric Company on December 8, giving to that station a total rating of 386,000 kw. The new unit will burn powdered coal. It will operate at 60 cycles. Steam pressure will be 425 lb. and temperature 750 deg. It is the eighth unit to be installed at the Huntley station. A similar one is to follow.

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Plan Dams for Power on Brazos and Rio Grande

SURVEYS AND PLANS have been prepared by the State Board of Water Engineers in Texas for the construction of a large dam on the Brazos River at Mineral Wells and a series of smaller dams on the upper reaches of the same stream in west Texas, all of which is to be a part of a fifty-million-dollar program for the conservation of the waters of the river, according to John A. Norris, chairman of the board. A dam at Mineral Wells would serve a twofold purpose, Mr. Norris said, that of impounding the waters to prevent overflow of 1,500,000 acres of land and the development of hydro-electric power. The dams in west Texas would be built primarily for irrigation and as a municipal water supply source, he is quoted as saying.

Preliminary steps were taken at a recent meeting at Harlingen, Tex., of representatives of irrigation systems and land owners of the Lower Rio Grande Valley toward creating a master irrigation project to provide water for approximately 1,100,000 acres on the American side of the international boundary stream. The plan involves the construction of three dams on the Rio Grande for the storage of water to irrigate not less than 720,000 acres in addition to the area now under irrigation. In connection with these dams it is proposed to construct large hydro-electric plants, the cost of the irrigation project to be ultimately paid for from the revenue from these plants, if the promoters' plan succeeds.

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Public-Private Merger Rumored in Winnipeg

NEWSPAPER REPORTS in Winnipeg state that an offer by Nesbitt, Thomson & Company of Montreal to negotiate for the sale to the city of the entire business of the Winnipeg Electric Company, or as an alternative to purchase from the city its hydro-electric system, is believed to have been made to Mayor Webb. No official confirmation is forthcoming. The City Council for some time has been discussing the possible purchase of the company and consolidation of Winnipeg's light and power industry.

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PLACE DE LA CONCORDE, PARIS, AS RECENTLY ILLUMINATED

—Keystone View Co.

Dickson & Thurber from Ewing Galloway.

Every year since 1920, between Christmas Eve and New Year's, this mile-long stretch of Himalayan cedars has been made the center of the Altadena, California, celebration. On these two hundred "Trees of God" thousands upon thousands of electric lamps are hung to tell the story that is ever new

Once again — **Merry Christmas**

EDITORIALS

L.W.W.MORROW
Editor

Trends in regulation

IN TWO years a few significant changes have taken place in the mosaic of utility regulation by the states. The mere fact that they are so few is in itself ample testimony to the general sufficiency and effectiveness of the institution. A considerable furor had arisen before 1928, and much effort has been applied to give it momentum; nevertheless, in spite of the aspersions on the regulatory institutions, the state legislatures and popular referenda have done relatively little to alter the scope of regulation. Such changes as have been made have been in the direction of confirming utility regulation as the only surviving substitute for free utility competition—and chaos.

Foremost is the recognition by the states of the imperativeness of obtaining and retaining commissioners of superior caliber. Ten states have made salary increases of from $200 to $3,000, with the result that the national average in two years has risen from about $4,000 to a level of $5,275. The six-year term still predominates. Arkansas and Oregon commissioners will henceforth be appointed by the respective governors. Virginia has substituted election by the General Assembly for popular vote.

Vermont will now regulate accounting; Maryland and New York will henceforth prescribe the uniform classification of accounts. Massachusetts grants to its commission the power to initiate complaints and investigations. New York adopts the terminable-permit idea. One state removes from the jurisdiction of its board the regulation of accounting of municipal plants. Several additional states prescribe control over transmission lines and wire crossings. Delaware continues to be the only state without a commission.

On the whole, the tendency has been to fortify commission regulation. One trend, regrettable in some respects, is the extension of the duties of the commissions to new fields—ice, warehousing, workmen's compensation, radio, aviation, taxicabs, gasoline sales. Until solutions of current problems in rail and bus transportation and in the household utility services have found more general acceptance by the public it seems hazardous to diffuse the activities of the regulatory boards. The principal consolation to the utilities rests in the appearance of new problems to engross the public's attention on a plane of equality with those involved in electric, gas, telephone and water service. Commendation is due Bonbright & Company for compiling and charting these pertinent facts of utility regulation for the benefit of the industry and its investors and, as well, the student of law and political economy.

Muscle Shoals as a test

GOVERNMENT operation of Hoover Dam is an accepted fact, and political indicators point to a similar disposition of Muscle Shoals. In the Hoover Dam case irrigation is mixed with hydro power, and governmental jurisdiction stops at the plant switchboard. In the Muscle Shoals case chemicals, fertilizer, navigation and a steam plant are mixed with hydro power, and Senator Norris insists that the government build and operate transmission lines.

Granted that both decisions violate the fundamental American principle of private operation, the greatest care should be exercised to see that actual costs and returns be made available to the country. It is a difficult accounting task to sepa-

rate power costs and returns from other activities associated with these water-power developments, but it should be accomplished. Legislative provisions should at least protect private industry against unfair competition, and the people are entitled to know the facts about the operations.

The growing economic disadvantage of hydro power as compared with steam power, especially in the Muscle Shoals district, offers even now a very serious handicap to government competition with private utilities, even on a cost-of-power basis. This handicap promises to become greater. All the elements in these test cases make it advisable to institute for these projects both an accounting system and legislative safeguards that will make facts available.

Better late than never

"I THINK that some time later in this investigation, when all of the facts have been brought together on the subject of these recorded appreciations or write-ups, the general subject of their effect might be reviewed in evidence. When that time comes, I have no doubt that the commission will ask for an expression from various people, including those that the industry may see fit to select."

Thus spake Chief Counsel Healy in the closing day of the Federal Trade Commission's hearing on the affairs of the Georgia Power Company. It gives adequate assurance that both sides, the inquisitor and his victim, will ultimately have a chance to spread their cases before the public. But it is certain that no such publicity will voluntarily attend the recital of the sober economic justification for consolidations and adjustments of book values as has attended the disclosure of these transitional events in the history of the industry.

Time, much time, will have elapsed before the accused has his day in court, and what he pleads will be discounted by its remoteness from the allegations. To compensate for this, much of the fervor with which the radical press has displayed the implications will also have subsided. Maybe the postponement of the rebuttal will better permit a calm and unimpassioned survey of the ethics and economics of the merger concept. Meanwhile the other channels logically available will have to be employed to tell to investor and consumer alike the real story of electrical evolution from obscure infancy to self-respecting manhood.

Balanced engineering needed in selecting industrial drives

AFTER the formal papers were presented at the textile division session of the recent annual meeting of the American Society of Mechanical Engineers and the conferees had, figuratively at least, reached the point where collars were loosened and sleeves rolled up for a really frank discussion, the question of group versus individual machine drives developed. There was evident a refreshing sanity of opinion: Individual drives for machines which operate under virtually constant load and where appearance and local control are paramount; group drives where many machines with fluctuating loads, high starting power peaks and varying character of production operations suggest the benefits of capitalizing upon diversity. By and large, the newer and supposedly more popular individual machine drive idea had rather the worst of it. Undoubtedly the fact that most of the audience belonged to a special group was part of the story.

One advocate told of conditions in his own plant where a 100-hp. group drive, at the sacrifice of something in the way of appearance, did the job for which 600 hp. in motors for individual machines would have been required had the diversity element not been capitalized. In another plant, with a power bill of $3,600 a year, saving through full loading of a few motors rather than lightly loading many brought a reduction in energy saving of $75 a month, through influencing power-factor clauses in the rate. By analyzing machine operations in a Canadian plant it developed that not once in three weeks did the peak load of any two or more of a group of four machines occur simultaneously. Motors were selected for a group drive accordingly.

Good engineering means here as always balancing the important factors and proceeding on the basis of the facts logically developed. What penalty on profits and production is warranted

for the unevenly loaded individual drive where appearance has dominated the decision? What price is paid in diminished safety and necessarily inadequate lighting where under adverse conditions group drives have been installed on an economy basis alone? Good engineering—good balance of important factors.

Chromium plating installations require protection

CHROMIUM plating is being extended to so many things—plumbing fixtures, hardware, household appliances and automobiles—that wiring for power, light and signal systems in these plants must be kept free from injury by acid fumes and vapors. The deposition of the lustrous metal is attended with copious evolution of gases which provoke a spray of chromic acid. Fume ducts and fans are invariably applied to remove the corrosive atmosphere; nevertheless sole dependence cannot be placed on the ventilation scheme. Natural circulation of the air in conjunction with door and window openings abetted by walls and partitions results in the corrosive agent being carried to vulnerable objects. Even though the air be only weakly corrosive, the cumulative effect may be disastrous.

Present systems should receive increased protection and new systems should be carefully laid out in contemplation of the hazard. Vapor-proof fittings, fixtures, wall-switch covers, plug-receptacle covers and similar appurtenances are essensential to prevent the fumes reaching the brass and copper parts. Galvanized conduit with enamel coatings should suffice to protect the wiring and ducts. Gaskets should be used with plug boxes to seal cover joints. Cabinets should in general be placed where they will not be reached by the fumes.

It is unfortunate that so welcome an innovation as chromium should entail so destructive an accompaniment as the acid vapors emitted in the plating process. With care and foresight, however, protection that will assure prolonged life and service can be given to the peculiarly susceptible metals employed generally in electrical circuits and devices.

Need for a gage of bond market saturation

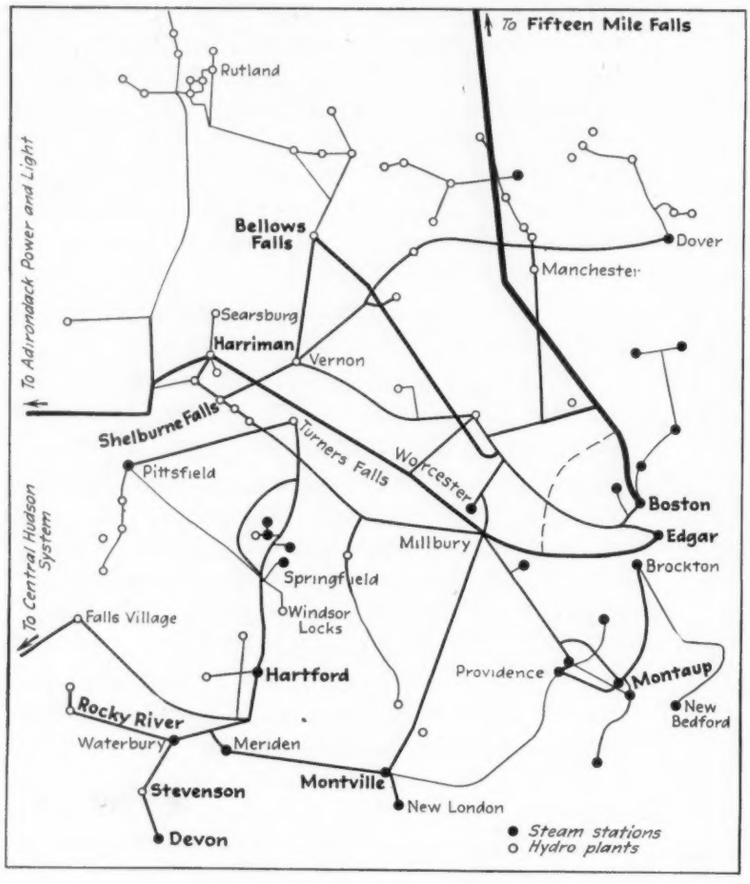
SAGGING prices of power and light bonds in the face of cheap money and an apparently heavy institutional demand for highest-grade issues do not connote any weakness or defect inherent in the industry itself. Nor do they herald anything in the nature of defaults—all bonds of industry are sagging. They do, however, suggest an inherent defect in the lack of adequate means of gaging the market's absorptive capacity at any given time. They reflect, too, the absence of any means of restraining those groups that disregard such indications of saturation as exist.

For some years industry as a whole has been making huge annual additions to the available supply of bonds. "What the traffic will bear" seems often to have been the only criterion. Power and light companies issued more than twice as much in bonds this year as last. New issues placed on the market by all industry during the first half of this year exceeded $4,500,000,000. There is evidence that much of this is still seeking a permanent resting place, despite the nonchalant but usually meaningless assurance, "This issue is already oversubscribed," and notwithstanding the current assertion of a prominent investment banking house that the unsold bond surplus is not large. Bonds previously sold are being thrown back on the market.

The remedy is not obvious. Industry's rapid expansion must be taken care of. But it takes no prophet to predict the outcome unless some restriction or restraint is found. It is a popular pastime to blame the Federal Reserve banks, charging that they have winked at excessive discounts and have allowed funds of the Reserve system to flow freely into the open market.

The problem goes farther than this. The remedy, whatever it may be, rests largely in the hands of the investment banking and stock exchange fraternity. High-grade houses, of course, discriminate and frequently withhold issues from a saturated market. But such action is defeated by the few who do not discriminate. As for a means of gaging the absorptive capacity of the market, it has not yet been demonstrated that a cataloging of undigested issues is impossible.

Tie Lines and Steam Plants Offset



CENTRAL and Eastern portions of the United States have been subjected to the most severe drought during the last year in the climatological history of the United States, according to Dr. C. F. Marvin, chief of the U. S. Weather Bureau. By the first of September the drought had continued for nine months in the Middle Atlantic area, six months over the Ohio and Mississippi valleys and for shorter periods in nearly all other sections east of the Rockies.

To ascertain what effect the drought has had on utilities operating hydro plants several utilities in different sections of the United States were asked for the accompanying data on relations of hydro, steam and purchased power to total for a recent 30-day period in 1930 and the corresponding period in 1929. A limited period was selected in the hopes of showing the cumulative effects of the drought, but as comments from some companies will reveal, the significance of the data must be tempered by the conditions on the system.

As might be expected in this day when utilities are widely interconnected and steam plants are used to back up water-power plants, service to consumers has not been curtailed. But the reports from companies which have had to reduce hydro generation demonstrate forcibly three things that have always been contended: (1) Hydro plants must be supplemented by large water storage, reserve steam stations or interconnections with other systems if service to customers is not to be curtailed by vagaries of stream flow; (2) the cost of hydro power should therefore include a pro rata share of the fixed and operating charges on reserve steam stations and tie lines, and (3) interconnections with other companies, not limited by state boundaries, are many times essential to providing continuous and adequate service during emergencies.

Despite the drought, it is interesting to observe that Pacific Coast plants show more hydro power generated in 1930 than in 1929, but in one case the ratio of hydro generation to total has decreased. In this case the proportion of steam generation and purchased power has been greatly increased, apparently to make up for the curtailed hydro generation. On all the Pacific Coast systems reporting the proportion of purchased power has increased, although it does not represent a very large portion of the total except on the Puget Sound and Pacific Gas & Electric systems. One Southwestern company likewise increased its hydro generation.

In other parts of the country, with the exception of companies 2, 3 and 5, the proportion of hydro generation has been reduced and steam power or purchased energy or both increased. The most striking reductions in percentage of hydro power generated are evident in the reports of companies 4 and 7. Both of these companies have made the largest increase in relative use of steam.

While four cases are shown in which the percentage of purchased power has been doubled this year, it is possible that some of the companies have reported only net power interchanged with other companies, so the value of tie lines in emergencies is not so clearly demonstrated as if the gross energy purchased had been reported.

Comments from the companies reporting these figures are essential to interpreting their significance.

For example, the Southern California Edison Company (11) points out that "a comparison of a short period of one year with a similar period of another year, in the operation of a company with large storage facil-

Water Shortage

ities, may be misleading, as operating conditions sometimes require different distribution of the use of storage water from year to year. In this case the hydro output for October was 45 per cent higher in 1930 than in 1929, but the actual water resources were practically identical."

The Puget Sound Power & Light Company (12), commenting on prospects for this winter, says:

"From our present outlook on rainfall and snow conditions in the mountains, we feel that this section of the country is in a better position than it was in the winters of 1929-1930 and 1928-1929. However, on this date (November 26) our precipitation since January 1, 1930, is 7.62 in. below normal, and therefore the outlook for this winter is somewhat below the average or normal year.

"The extent to which we will call on steam and purchased power during the winter months will depend greatly on future weather conditions, but no doubt our combined purchased and steam generated power will be less than in the two preceding years."

In explanation of the higher percentage of hydro generation this year, the Portland General Electric Company (10) points out that it had "practically no rain last year until well along in December, while this year it had considerable rain during the early part of November. During the coming winter the probabilities are that use of steam-generated power will increase to approximately 45 per cent of total generation before the end of the year. It is expected that the power to be purchased will amount to practically nothing

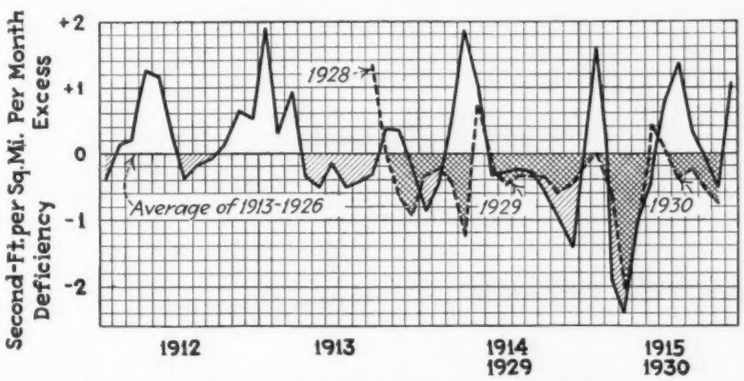
The Pacific Gas & Electric Company (13) reports: "With a normal season (predicted from this date) there will be no increase in demand on either steam or purchased power."

One Southwestern company (8) expresses the opinion that its data are liable to leave a wrong impression. By giving figures for October, it is showing "four times as much hydro generation in a dry year as in a normal year, yet the hydro generation for the entire year 1930 to October 31 is only 71.5 per cent of the same period last year. It so happens that October, 1930, while coming in a dry year was a wet month as Octobers go. Since the hydro plant is practically a run-of-stream plant, it is impossible to predict the prospect for this winter."

The data from the Connecticut Light & Power Company (2) might leave the impression that extremely good run-off was experienced in this company's territory, but "it has been below the average since the fall of 1928 and the company is now entering upon its third winter with ground storage depleted to an extraordinary extent."

The apparent inconsistency of the data is due to the performance of the Rocky River pumped storage development—the only one of its kind in this country. The progressive deficiency in water on the Housatonic River during the last three years is quite comparable to that experienced in 1913 to 1915. During the latest low-water period the pumping process has accomplished exactly what it was designed to do—utilize power from other sources to pump and store water in the Rocky River reservoir until such time as the reduced flow in the Housatonic River necessitated an enhanced supply to keep the plants at Rocky River and Stevenson at economic levels of output.

Much of the power was obtained through the Connecticut Valley Power Exchange from plants on the upper Connecticut River which otherwise would have been passing water over their dams. In effect, the excess rainfall and run-off in the Connecticut River drainage area was transferred to the Housatonic area by electrical means. As a result the hydro-electric output from the Housatonic plants was not only 25 per cent greater in 1930 than in the corresponding period of 1929, but it was also about 40 per cent greater than it would have been with only the direct river flow available. The return of steam power from the Connecticut Light & Power system to the Connecticut Valley Power Exchange at other periods balanced the purchases of Connecticut hydro power and resulted in a zero net purchase for the year.



Departures from average flow in Housatonic River

Even though rainfall resumes its normal activity or better for the rest of this year, it is not expected that the run-off will improve materially, because the ground is so far from saturation as to absorb an inordinate share of the precipitation. "The resulting hydro deficiency will obviously have to be made up from steam or other sources."

On the Central Maine Power Company's system (3) "it will be possible, with the present water supply, to carry approximately 80 per cent of the load with hydro power during the coming winter. Should heavy rainfalls occur before freezing weather sets in it will undoubtedly

Effect of Recent Water Conditions on Proportions of Hydro, Steam and Purchased Power

Except where otherwise indicated the reports are based on a recent 30-day period falling in interval of October 1–November 30. Some of the apparent inconsistencies are explained in the comments.

Company	Ratio of Hydro Generation in 1930 to 1929, Per Cent	Ratio of Hydro Generation to Total Including Purchased Power, Per Cent		Ratio of Steam Generation to Total Including Purchased Power, Per Cent		Ratio of Purchased Energy to Total, Per Cent	
		1930	1929	1930	1929	1930	1929
New England							
1. Western Massachusetts Cos.	71.5	20.5	24.7	13.0	25.6	66.0	50.0
2. Connecticut Lt. & Pwr. Co.	125.0	15.5	11.4	84.5	88.6	0	0
3. Central Maine Power Co.	118.0	67.0	58.4	17.8	20.8	15.2	20.8
Middle Atlantic							
4. Large Middle Atlantic	10.2	4.7	41.9	93.1	56.9	2.2	1.2
Southeast							
5. Duke Power Company‡	77.7	78.8	70.3†	21.2	29.7†	0	0
Middle West							
6. Northern States Power Co.	82.0	29.0	37.0	62.0	56.0	9.0	7.0
7. Louisville Gas & Electric Co.	36.0	31.0	86.0	68.0	13.5	1.0	0.5
Southwest							
8. Southwestern Company	465.0	3.0	0.7	97.0	99.3	0.6	0.7
Pacific Coast							
9. California-Oregon Power Co.	108.0	77.0	98.0	17.0	0	4.0	2.0
10. Portland General Electric Co.	132.0*	58.6	43.7	41.0	55.0	0.4	2.4
11. Southern Calif. Edison Co.	143.0	62.0	41.9	37.4	57.8	0.6	0.3
12. Puget Sound Pwr. & Lt. Co.	128.0*	61.4	49.2	18.9	33.3	19.7	17.5
13. Pacific Gas & Elec. Co.	141.0	75.6	51.9	4.6	3.2	19.8	16.0

*Ratio of hydro capacity factor in 1930 to 1929. †Average for last five years. ‡Based on first ten months of year.

be possible to carry more hydro load. It is rather difficult at the present time to anticipate the steam need because it is not known exactly when the Bingham plant will be available. Should Bingham be able to operate the first part of next year, it will probably be possible to eliminate steam power and some of the purchased power."

During the balance of the winter the Western Massachusetts Companies (1) expect there will be more water than there was during the 30 days of October reported. On November 22 there was about 50 per cent more hydro available than the average during October.

The Middle Atlantic company (4), which shows the largest reduction in proportion of hydro generation and the biggest increase in percentage of steam generation, points out that "even should the drought continue, the hydro plant will still be able to carry practically full capacity on peak operation, thus displacing the equivalent steam capacity. The steam capacity in operation, however, will operate at a considerably increased load factor. No noticeable increase is expected in purchased energy."

From Niagara Falls, where the flow would be expected to be relatively uniform from one year to the next, comes the information that the Great Lakes level has been above normal for the last two years, but has been declining during the last year.

The water powers of Alabama and Georgia are on different watersheds, the run-offs from which are not always coincident. By electrical interconnections the power generation on either watershed can be made available to the other as a vital reserve.

No data were reported by the Alabama Power Company because it thinks that the circumstances connected with its operation would have made the data requested misleading. For example, "the three hydro-electric plants on the Coosa River have no appreciable storage and must use the river flow as it occurs, whereas the three plants on the Tallapoosa River, by virtue of a large storage reservoir, are able to store floodwater during the rainy season and utilize this water during the dry season. The storage in this reservoir with maximum drawdown amounts to 300,000,000 kw.-hr. Therefore, the Tallapoosa River plants perform very much the same sort of service as a steam reserve plant would in that they supplement during the dry season the power delivered from the Coosa River plants.

"In addition the company has two reserve steam plants at Gorgas with a total capacity of 130,000 kw. and a one-year contract with the government's Wilson Dam plant, the minimum capacity from which during 1930 amounted to approximately 50,000 kw. Under the government contract power must be taken from Wilson Dam when available before starting steam plants. Owing to the temporary nature of this contract, however, it has not been possible to avoid the necessity of providing reserve steam plant capacity.

"Owing to favorable weather conditions in 1929 and the early part of 1930, the Alabama Power Company reached the dry season of this year with its Martin Dam reservoir full. These circumstances have combined to hold steam generation this year down to about 8,000,000 kw.-hr., a nominal amount in comparison with the total output.

"It is specially interesting to observe that, notwithstanding the availability of Martin Dam storage and the energy from Wilson Dam, it was still necessary to operate for a short time one of the steam plants up to 60,000 kw. Had the Wilson Dam capacity not been available this year, an additional 50,000 or 60,000 kw. of steam capacity would have been needed.

"Even though the company owns large hydro storage plants, it has been necessary for it to provide steam reserve to back up its run-of-river hydro plants."

As indicated in the table, information from the Duke Power Company (5) was "based on the first ten months of the year compared with the same period in 1929, instead of on the 30-day period requested, as it is entirely optional with the company to operate either steam or water over a period of 30 days, depending entirely upon what the outlook for power requirements may be. Unless the general storage conditions are taken into consideration the actual hydro generation does not give any criterion whatever as to the possible hydro generation."

The Virginia Electric & Power Company experienced a drought starting in May which cut down hydro generation to 72 per cent of the average for the last three years. In successive months this hydro output dwindled until in October it was only 8 per cent of the May output. Were it not for interconnections with other systems and steam plants many communities would have had this service curtailed by the drought.

Data were not reported by the Pennsylvania Power & Light Company because its only hydro-electric plant—"the Wallenpaupack plant—is unaffected by any temporary water shortage. This plant stores water from one year to the next, and the company is enjoying, as usual, the full designed output of the station from day to day in accordance with the design of the plant."

Adequate Lighting Speeds Traffic Along and Across the Welland Canal

Nowhere in the electrification of the Welland Canal has an opportunity to do things electrically been neglected. Bridges are speedily and safely raised in quick order; locks are filled faster than ever before; adequate control insures safety, speed and proper sequences.

In lighting the locks and highway bridges speed and safety again dominated. The span of the bridges is illuminated by 200-watt "Mazda" lamps in 16-in. RLM domes spaced 24 ft. apart at an average mounting height of 20 ft.

A special unit has developed for lighting the locks. In all there are 450 such units on the eight locks. This unit consists of a cast-iron, porcelain-fire-enameled hood and canopy. Various combinations of glassware can be used with 500-watt and 1,000-watt lamps. Units are spaced at 150 ft., mounted opposite, height 25 ft., and at present use an 11-in. refractor with 750-watt lamps in the four units at each end of the lock and 500-watt lamps in all others.

Courtesy General Electric Company

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Poland's Electric System Not Extensive

Poland and a number of other eastern European states do not yet possess very extended electric power supply systems. The most important power centers are in large cities and industrial districts (Dombrowa). The total rating of power plants in operation in 1929 was 1,270,000 kw. and their output was 2,931,000,000 kw.-hr. Bulk power is furnished by 26 district power plants having a total rating of about 224,000 kw., and an output, in 1927, of about 750,200,000 kw.-hr., or about 33 per cent of the total production of the country. The largest power plant (at Chorzow) belongs to the Polish state, is rated at 83,000 kw. and turns out 423,000,000 kw.-hr. yearly.

The largest consumption of energy is in the western part of the country. In Upper Silesia it is 1,148.8 kw.-hr. per capita per year; Warsaw shows 110.5 kw.-hr. and Kielce 114.4 kw.-hr. The mean value per capita ranges between 20 and 90 kw.-hr., but in some eastern districts a consumption of only 1.5 kw.-hr. or even 0.9 kw.-hr. per capita (Tarnow) exists.

The largest number of power plants belongs to private companies, but some important central stations are owned by the government. The future development of the production of electric energy in Poland will very probably remain under the government control, according to Nikolay von Kotschubey of Zurich, but private companies will be authorized to take over concessions for the supply of electric power in different districts of the country. American firms have shown a keen interest in the development of the electric power in Poland. Detailed offers have been submitted by several well-known American consulting engineers, but for the time being none of these proposals has been accepted by the government, Mr. Kotschubey reports.

Supplying Power to Floating Dry Docks

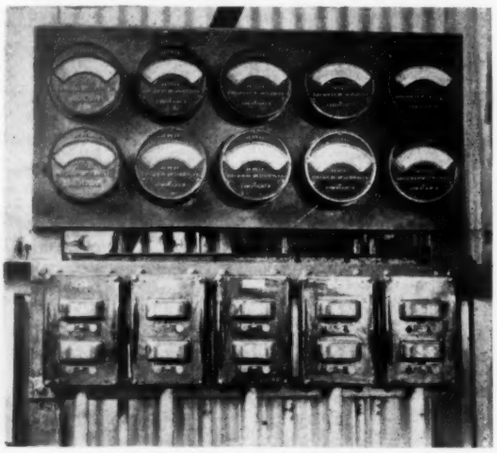
By EMIL KUN
Electrical Engineer, New York City

PROVIDING the necessary feeders for the ten 75-hp. pumping motors on the 10,000-ton, five-section drydock which was installed at the foot of Thirteenth Street in Hoboken, N. J., by the United Dry Docks, Inc., as part of extensive improvements in their Fletcher plant, presented some new problems in distribution.

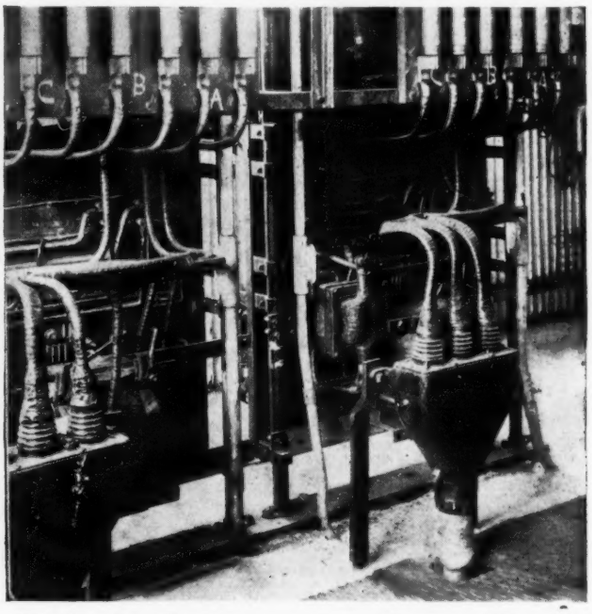
The individual motor feeders are run along the pier to junction boxes at each of the dock sections, where vertical risers and flexible cable jumpers connect to motors on the top of the dock wings. It has been the customary practice to run these feeders as lead cables installed in iron conduits either on top or on the sides of the pier. An investigation of such installations showed, however, that the proximity of salt water and the extremely high humidity of the air cause rapid deterioration of these conduit lines. In order to prevent this it was decided to install the cables without conduit. Since the cables must be mechanically protected, submarine-type cables inclosed in a wooden trunking were selected. A total of five No. 2/0 six-conductor varnished-cambric, wire-armored, jute-covered submarine cables were installed, each serving two motors of a drydock section.

This type of installation is considerably less expensive than the standard lead-cable and iron-conduit installation. It is also believed by the designers that this system will result in low maintenance and high reliability, which for operations of this kind is of extreme importance.

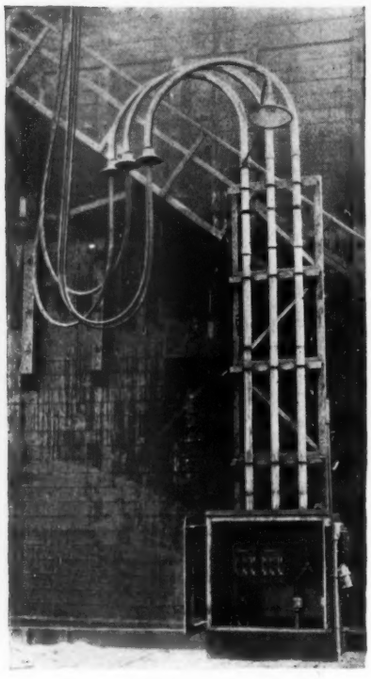
The installation was designed and made under the supervision of Baker & Spencer, Inc., New York City.



Master controllers and ammeters for pumps centralized in room overlooking drydock

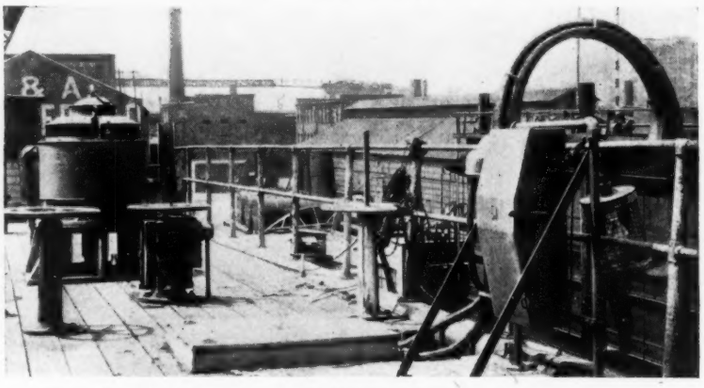


Potheads afford connection of control board with feeders to drydock motors

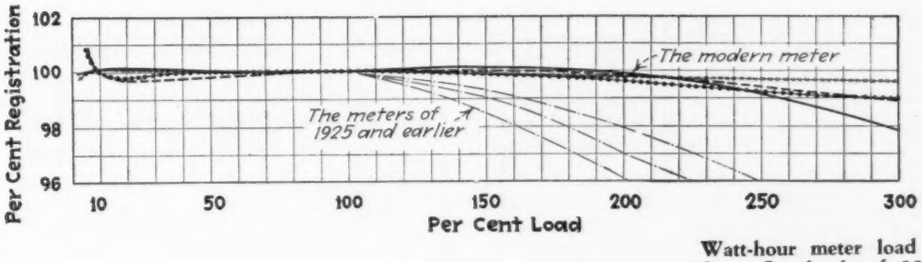


Jumpers connect junction box on pier to wing of drydock

60-amp. receptacle on box permits connection of portable welding sets. Two of jumpers serve motors, while third supplies temporary lighting for ships in dock.



Terminal of jumper cable on drydock wing feeding vertical pump motor



Watt-hour meter load curves now very flat. Overloads of 300 per cent incur only 1 to 2 per cent loss in registration. Older meters had more slow error at 100 to 150 per cent overload

Watt-Hour Meters on New Plane of Accuracy

By A. E. KNOWLTON

Associate Editor "Electrical World"

Accuracy on heavy overloads greatly enlarges scope of all ratings. Temperature compensation removes most limitations on meter location. Less variation with slight changes in voltage and frequency

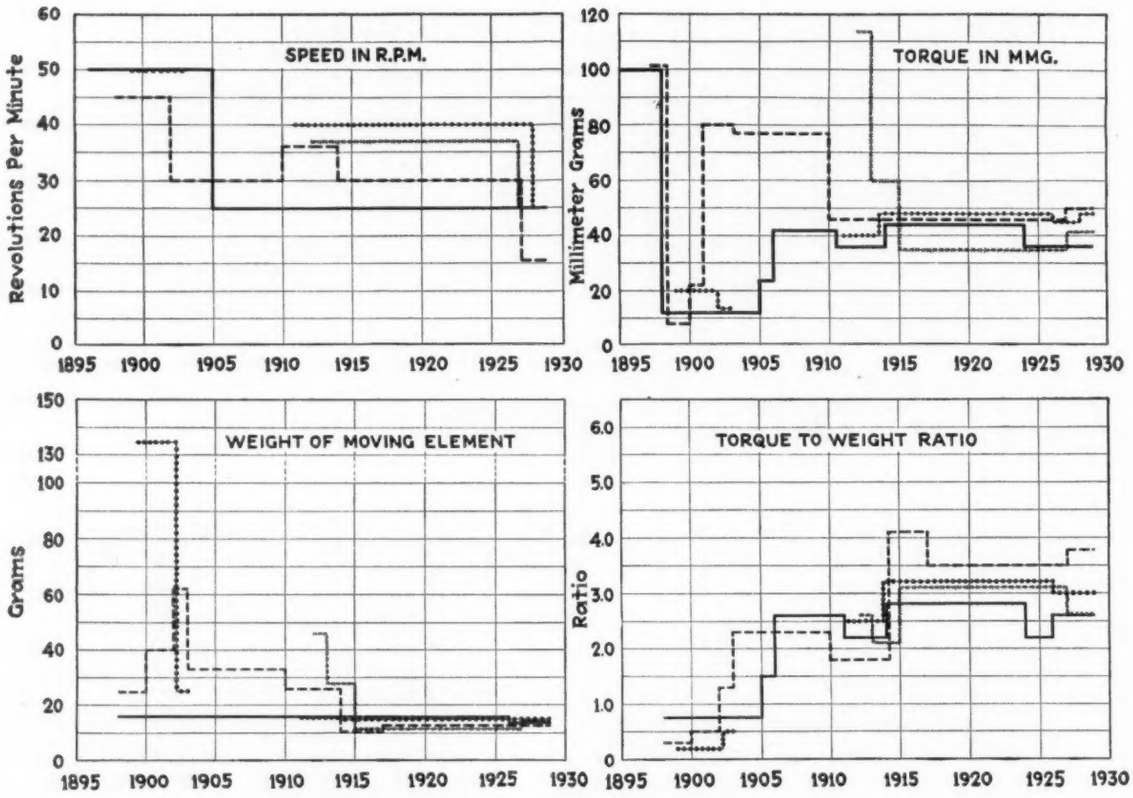
AS THE aim of more use by each customer is realized in practice it means more load per meter. Appliances are doing their part in increasing the kilowatt-hours, but higher lighting wattages and longer burning hours still contribute the major portion of the enlarged utilization by the whole group of residential and small commercial users. Meanwhile the lightest loads are still at the former levels. There has manifestly been created a demand for a meter that would have the light-load accuracy of the prevailing 5-amp. meter and a better accuracy with loads in excess of the 5-amp. rating than the meters of five years ago had. This demand has been anticipated by the producers of watt-hour meters, and the result is the availability of meters which are still rated nominally at 5 amp., but have as good accuracy at 15 amp. as the older lines had under loads of 6 to 7 amp. Some of the earlier meters were 6 to 10 per cent slow under 300 per cent load conditions.

While increased utilization in the average home and small store and office toward a 4,000 kw.-hr. per year goal is becoming a reality, the modern 5-amp. watt-hour meter will take care of the transition period; the use of the smallest consumer and of the one who makes liberal and sustained use of his appliances will be recorded with a higher degree of over-all accuracy than would have been possible with the former meters unless capacities had been skillfully matched to ascertained loadings. With the improved overload and retained light-load accuracy have come improved behavior on varying voltage, frequency and temperature.

These improvements have not, of course, been confined to the 5-amp. rating. The other capacities have been equally benefited and the polyphase elements have had the new features incorporated in them. Actually it is also fair to assume that the logical consequence will be a trend toward concentration on a lesser number of ratings, maybe 5, 15 and 50 amp., to cover the principal range of the self-contained meter. Simplification and standardization will thus be a direct consequence of the technical advance in meter art. Concurrently and incidental to the progress in electrical performance have come better mechanical features, including standardized terminal arrangements and adapters. Polyphase meters also can now be obtained with open-circuit potential indicators to disclose a non-functioning element.

Series flux causes overload droop

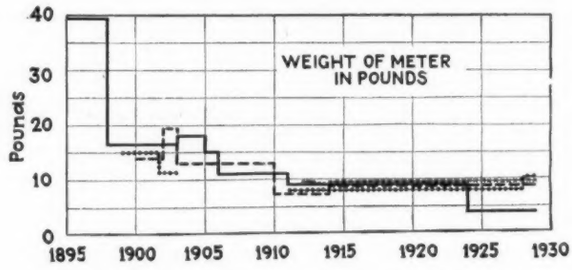
The characteristic overload droop of the older watt-hour meter was due to the damping effect of the flux created by the excess current in the series coils. The preferred method of accounting for the torque production in the induction watt-hour meter is to attribute it to the interaction of flux from one of its poles with eddy currents induced in the disk by the alteration of flux from one of the other poles. The resulting torque drives the disk at a speed for which the retarding torque from the brake magnets rises to equality with the driving torque. Unfortunately, in some respects, the motion of the disk carries it through the working fluxes as well as through the brake magnet flux, and herein originates the considerable overload droop characteristic which was a common residual of all the earlier meters.



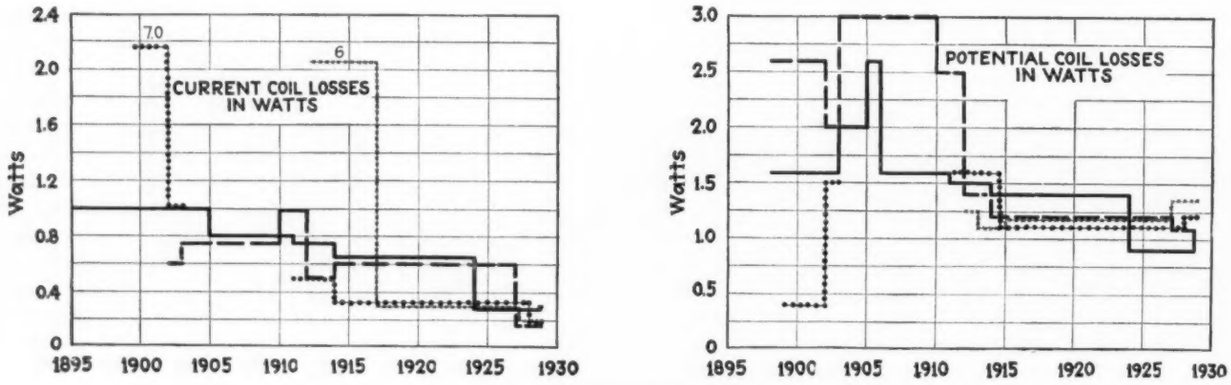
Thirty-five-year trend of meter characteristics

Speeds have lately been decreased; torques have been fairly constant for fifteen years; weights of moving elements likewise unchanged; ratio of torque to weight was steadily increased to a stabilized average of 3.0 before 1915.

With constant voltage the braking effect due to the voltage flux is proportional to the speed of the disk and may therefore be considered as part of the necessary braking, the bulk of which is contributed by the permanent magnets. But the flux from the series turns varies with the load current and therefore exercises a variable damping effect. As it increases with increasing load it contributes a proportional increase to the driving torque, thus tending to hold the registration curve flat. But its damping and retarding effect tends to increase as the square of the load and therefore of the current flux. The result is a contribution to the retarding torque



Weights today less than one-fourth the pioneer's value



Meter loss trend downward

Potential coil losses have hovered around 1.25 watts for fifteen years; current coil losses at rated current have been sharply decreased in the last five years.

greater than that to the driving torque and the meter balances its torques at a lower speed than should be the case. The meter, in brief, runs slow on the overload.

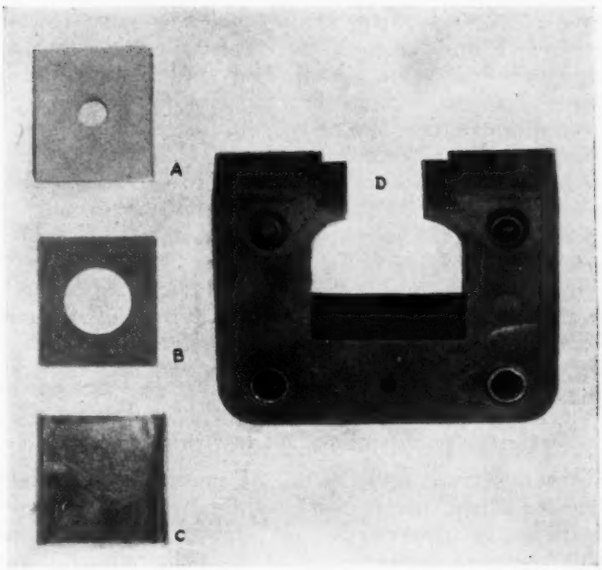
The droop has been eliminated in the new meters

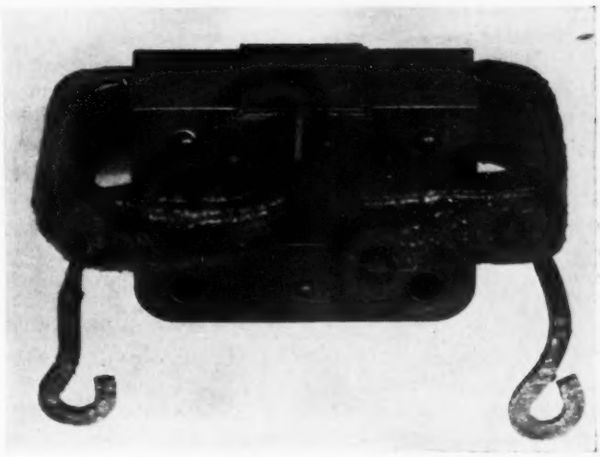
In giving the meter accuracy over a greater range of load no entirely new principles have been devised or applied. It has been a matter of more critical analysis of the interacting forces, the reproportioning and closer co-ordination of design and the advantageous utilization of the properties of new materials. The air gaps, magnetic paths, rated speeds and the losses, both in copper and in iron, have been scrutinized and realigned. Some designers have adopted lower speeds; lower speed demands relatively stronger magnets, and the effect of damping due to the current flux is thereby diluted and the overload droop ameliorated. A general reproportioning of the magnetic paths and the flux magnitudes added more compensation. In some instances no compensating accessory was added to the meter; the improvement preserved all the original simplicity in structure. In some cases the addition of a simple compensating bridge to the current electromagnet provides for shunting a portion of the flux away from the disk gap up to full load; above full load its reluctance increases and an increasing portion of the total current flux passes across the disk, thus enhancing the driving torque more than it adds to the retarding torque. The result of these various advances in design is to give the recent 5-amp. meter as little droop in accuracy at 300 per cent load as its predecessor had at from 125 to 150 per cent of load.

The induction watt-hour meter is composed essentially of copper, aluminum, steel lamination and magnet steel. These materials have their inherent variation of conductivity, permeability and hysteretic properties with temperature. It is to be expected that the registration would vary with temperature unless some compensation is introduced to remove the residual resulting from the joint action of the various changes in its component parts. The factors which affect the phase-angle relation between voltage flux and series coil flux at unity load power factor can be segregated from those which primarily affect their magnitudes. The latter are characterized as class I errors, and those which affect the phase angle and therefore the registration at decreased power factors are denoted as class II errors.

The class I errors embrace change in flux of the brake magnets, change in resistance of the voltage winding and the lag coil (or plate), change in permeability and losses in the voltage coil laminations. Class II errors include the change in phase angle of voltage flux that accompanies change in resistance of the winding, in iron losses and in lag plate (or coil) resistance; change in resistance of the disk also affects the lag of eddy currents in the disk, but this effect is significant only at decreased power factors.

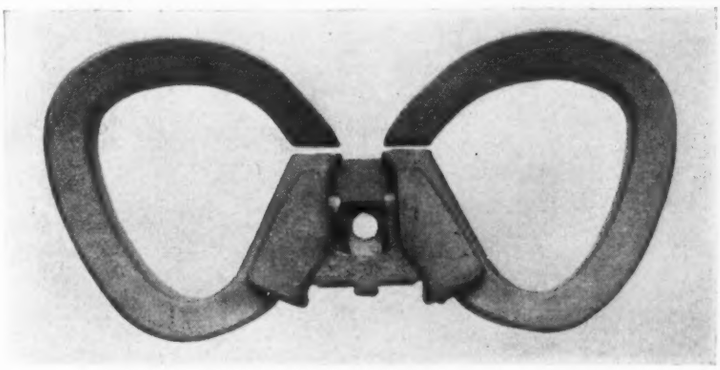
In compensating for these temperature effects it is quite natural that all manufacturers should have modified the magnet behavior to correct for all class I errors. This has been accomplished by applying to them, or to the full-load adjustment slug, a temperature-responsive alloy that shunts a





Bridge compensates for overload droop

Non-magnetic spacer (c) and magnetic shunts (a) and (b) inserted at (d) approach saturation at rated load and divert more series flux to air gap on overloads.



Temperature compensation at magnets

Calmalloy shunt regulates braking flux to correct for temperature departures of meter on unity power factor loads.

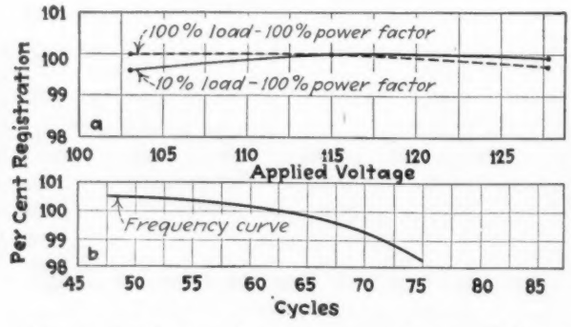
controllable portion of the magnet flux away from the disk and thus changes the braking torque to match whatever departure in driving and braking torque have resulted from the temperature change. In some cases two blocks of different composition of copper-nickel (Monel group) are resorted to in order to cover the temperature range likely to be encountered in meter practice, both indoor and outdoor installations. Some of the methods tried but abandoned involved the use of temperature-sensitive posts or bimetallic arms for supporting the magnets; these were calculated to expand with temperature at such a rate as to increase the radial location of the magnets when the temperature rises and weakens them. The braking torque was thus to be kept independent of temperature.

Better performance on low power factors

Characteristic performance of uncompensated meters showed a tendency to run faster on unity power factor loads as the temperature rose. Compensation has made this curve of temperature versus registration at unity power factor practically horizontal. In general, the meters tended to run slow on loads of lagging power factor and faster than at unity power factor when the loads were of leading power factor. Magnet compensation (class I) in improving the unity power factor performance tended to make the behavior worse on lagging power factor because the curves more or less preserved the angle between them. This angle was much greater in some makes of meters than in others. It thus became expedient in such cases to provide compensation for the class II errors, particularly in the case of polyphase meters, which normally operate at lower power factors than single-phase meters encounter.

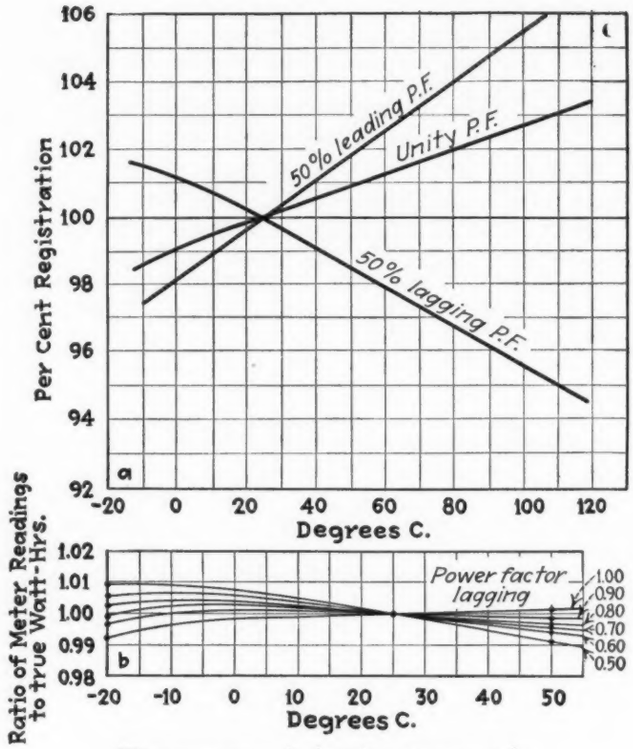
Compensation for the residual change with temperature in registration of low power factor loads has been accomplished in some cases by inherent magnetic design and in other cases by aiming the corrective effect at the resistance of the voltage winding. The tendency has been to reduce the resistance of the winding and thus minimize the effect of temperature change in its value. Another possibility is presented in the opportunity to lag the current pole flux enough to preserve the essential quadrature relation (at unity power factor) when the phase of voltage flux shifts with temperature; a figure 8 loop of copper (high temperature coefficient of resistance) is placed around the two current poles and a loop of, say, phonoelectric bronze (low temperature coefficient) around the voltage pole as a lag coil. Still another possibility is offered by a small reactor in series with the resistance of the lag coil; a temperature-sensitive insert in the reactor core controls the lag coil current value and phase angle in such a way as to correct for the spurious shift of the phase of the voltage-coil flux across the disk when temperature changes. These methods have succeeded in bringing the 50 per cent lagging power factor registration curve into close agreement with the leveled unity power factor curve obtained by magnet compensation.

To summarize, the error of watt-hour meters at 300



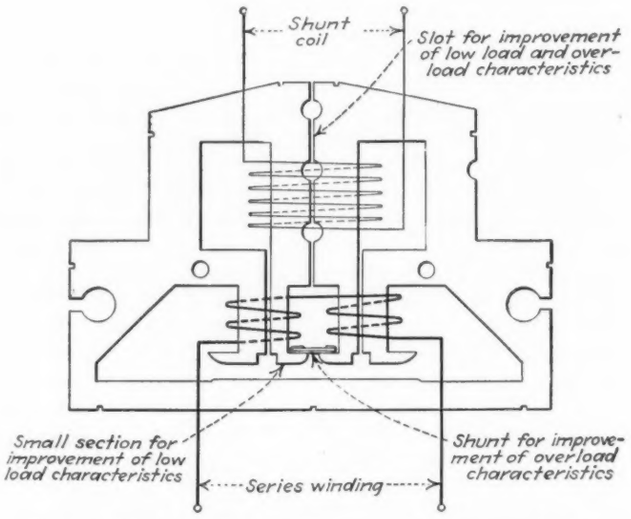
Typical effects of varying supply conditions

(a) Voltage. (b) Frequency.



Temperature behavior improved

(a) Typical behavior of a superseded meter at varying temperature and power factor. (b) The result of compensation and redesign of the modern meters.


Shunt coil
Slot for improvement of low load and overload characteristics
Small section for improvement of low load characteristics
Series winding
Shunt for improvement of overload characteristics

Example of redesign to control characteristics

per cent of rated load has been reduced to one-fourth or less of its former value. This signifies a direct increase in earned revenue for loads that have sustained peaks greatly in excess of the normal load for which a low-capacity meter may be adequate. At the same time there has been no sacrifice in accuracy on the light loads. The temperature compensation is a direct benefit to the utility user of watt-hour meters in three ways: (1) There is less restriction on the location of meters indoors or outdoors; (2) accuracy of measurement is better at all temperatures; (3) occasion for adjusting meters on periodic tests will be reduced if a compensated test meter is used to test a compensated service meter.

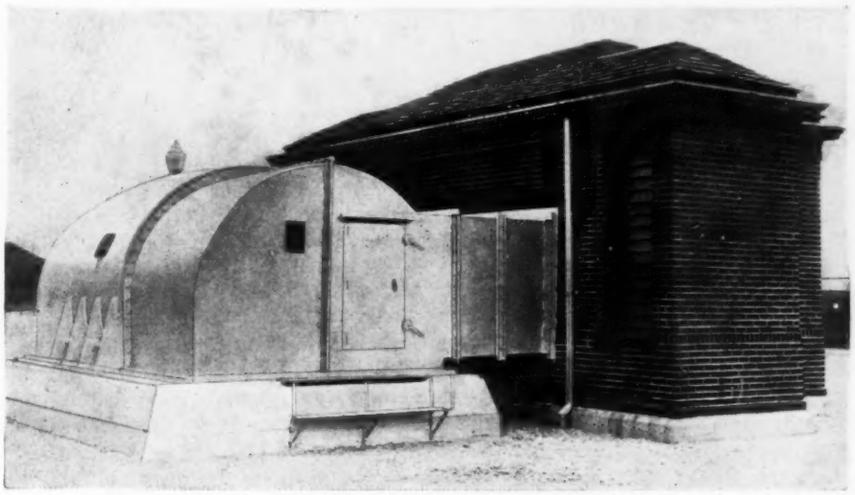
Undoubtedly much time in testing has been wasted by making seasonal adjustments when apparent errors are disclosed, whereas these apparent errors are in part due to differences in temperature effects between standard and service meter. Time is also saved in avoiding the warming-up period for the portable test meter. Time is saved and vexatious discrepancies are avoided in the laboratory calibration of a compensated portable test meter against precision indicating instruments that inherently have a much lower temperature coefficient than induction meters. Testing time and operating expense will also be saved as soon as the superior characteristics, permanence of adjustment and independence of variations in supply and in the surrounding temperature convince the regulatory commissions that longer intervals between periodic tests are justifiable and subsequently to be permitted in their jurisdictions.

▼ ▼ ▼

Energy Losses Used for Heating Station

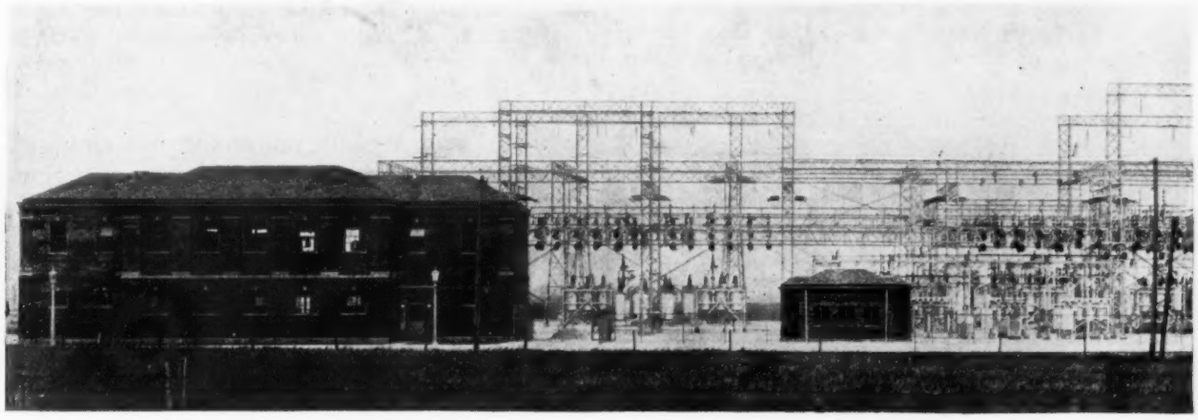
SEVERAL innovations were introduced into the design of Howard substation of the Ohio Power Company at Vernon, Ohio, which brought economies of construction and operation. One of the first installations of an outdoor type of synchronous condenser was made here to realize the benefits which minimized substation building structure brings. In planning for the heating of the control building it was decided to utilize the heat losses of the 15,000-kva., three-phase, 11,500-volt General Electric synchronous condenser. Air is taken through louvers in a small brick structure immediately adjacent to the condenser installation and, after filtering for dust and excess moisture, is passed through the machine and thence through underground ducts to the control building, where it is distributed as needed.

So satisfactory has the arrangement proved, according to Philip Sporn, electrical engineer American Gas & Electric Company, that another heating system installed for possible use when needed has very seldom had to be placed in operation in even the coldest weather. The 300-kw. heat losses unavoidably produced by the 15,000-kva. machine in normal operation have fully taken care of the situation.



Heat losses utilized for warming substation

The large building at the left, a control structure, is heated entirely by the warm air obtained from the outdoor-type synchronous condenser installed behind the smaller structure.



Reduces Cable Ionization by

For one year a process has been used at the Hastings-on-Hudson plant of the Anaconda Wire & Cable Company that has been particularly effective in removing occluded gases and moisture from compound and paper insulation before it is impregnated and in preventing contamination between steps in the process, with the result that a very low power factor is obtained even at high unit stresses.

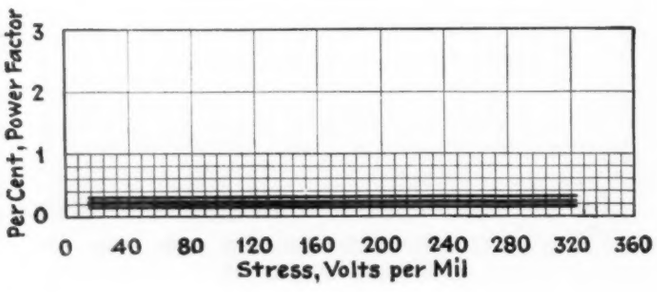
Among features of the process are the high vacuum employed in treating the compound and drying the insulation —1 mm. absolute pressure—and the facilities for measuring the degree of drying and impregnation while the cable is in process.

THE need of new methods of treating cable insulating oils and cable cores by extremely high vacuum has been disclosed by both practical field analysis of failures and by university research. In the practical field work, high-tension cable engineers of the various power companies conducted an organized study of cable failures, carefully examining samples of cable from every failure to ascertain the causes. Eliminating numerous purely mechanical failures due to faulty installation, many cases of unstable insulation were found. The high temperatures and operating stresses of practice produced changes in the oils which caused high dielectric losses, wax formation and even the formation of water and gases. Compounds that contained appreciable percentages of resin had to be discarded in favor of mineral oils to decrease power factor and dielectric losses at high temperatures, but electrochemical changes still took place. It was frequently suggested that a damaging amount of air and moisture, still remaining in the oil and paper voids, provided a basis for electrochemical reactions. Hence anti-oxidants were employed, only to be found unstable and of little permanent assistance.

Meanwhile, many noted cable engineers proposed theories of failure and presented much valuable technical information before domestic and foreign engineering societies. Of these, most important theories advanced were those of (a) maximum stress, (b) minimum stress, (c) average stress and (d) ionization. It is agreed that insulation failure is ultimately a voltage breakdown, but such failure is preceded by some sort of deterioration, which is usually localized. Apparently the theory of ionization seemed most important and, therefore, was given the most attention and study. As early as 1911 Steinmetz stressed the importance of the ionization of occluded gas or air spaces in insulation. Later, Shanklin and Matson presented an A.I.E.E. paper on this same subject. Abroad, Dubsky submitted a paper on the dielectric strength of air films.

Recently the N.E.L.A. and A.E.I.C., through their high-tension cable committees, embarked on a joint research program into the fundamentals of cable insulation and related problems. The treatment of the cable core and the compounds, with the object in view of developing some means of controlling ionization, was considered one of the most important features of the whole research problem. At Johns Hopkins University, under the leadership of Dr. J. B. Whitehead, the influence of residual air and moisture in impregnated paper insulation was investigated. At Harvard Prof. C. L. Dawes undertook the investigation of ionization in paper-insulated cables. Contemporary excellent and related work was done by Dunsheath, Riley, Beaver and Emanuelli.

The results of the Johns Hopkins University experiments have been published in the *A.I.E.E. Transactions* over the past three years. A close study of the conclusions indicates the great importance of extremely high vacuum treatment as a means of controlling the voltage at which ionization occurs. The ionization voltage can be increased from 80-120 volts per mil to 300 volts per mil



Figs. 1 and 2—Low power factor maintained up to high unit stress by high vacuum impregnation

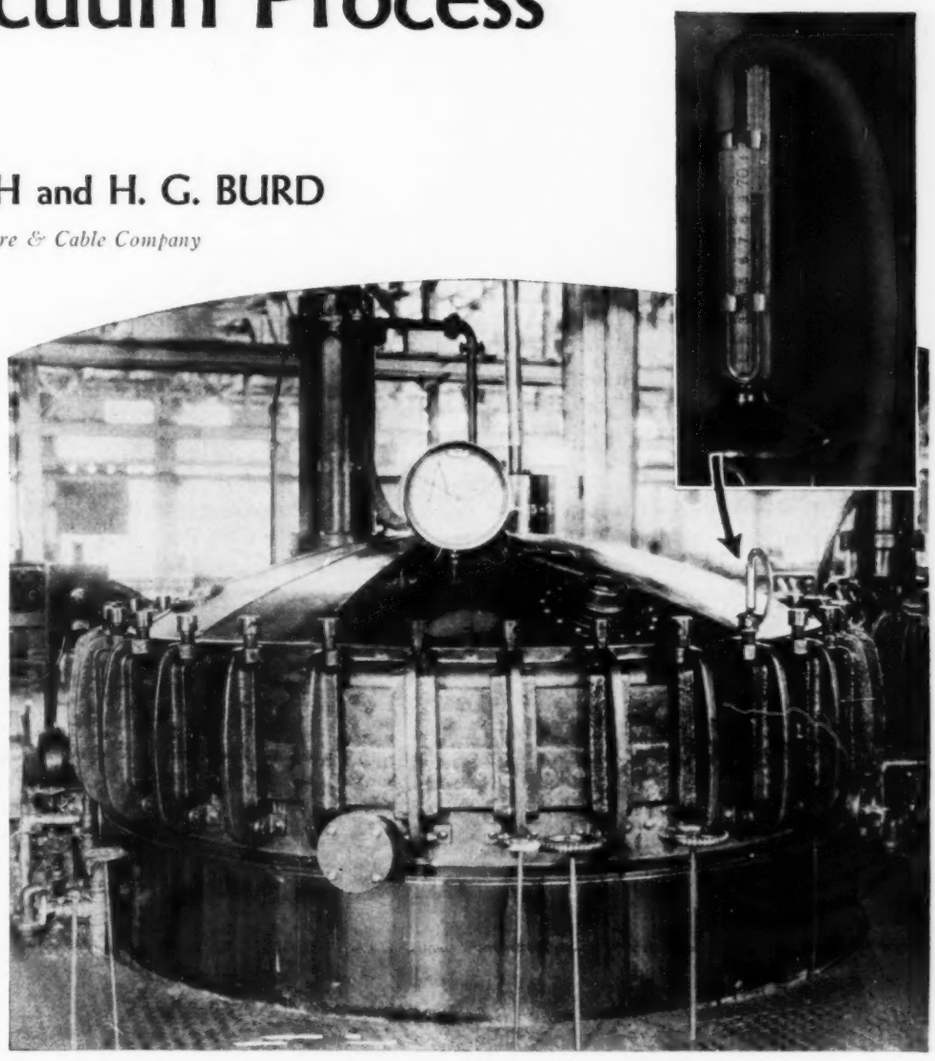
Fig. 1—Research results obtained at Harvard University on samples impregnated with different compounds, each having been treated by exposing thin films of compound to 1 or 2 mm. absolute pressure. The results illustrate that characteristics are practically independent of the type of compound. Factory results obtained by the Taylor process coincide exactly with these curves.

Fig. 2—The extreme importance of treating cable cores with a high vacuum to control ionization was demonstrated by Johns Hopkins research. Cable manufactured by Taylor process has flat power factor curve up to 200 or 300 volts per mil.

Super-Vacuum Process

By S. J. ROSCH and H. G. BURD

Anaconda Wire & Cable Company

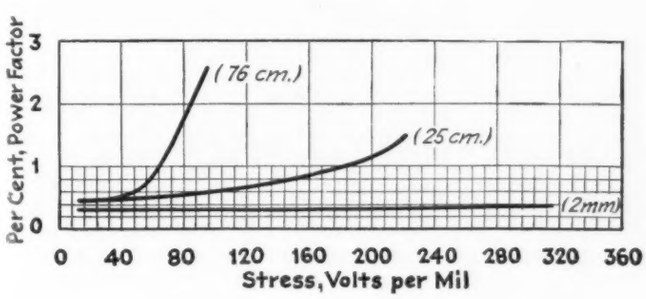


One of impregnating tanks under 1 mm. absolute pressure

in this manner. The work at Harvard, which has also been published in *A.I.E.E. Transactions,* has proved that all occluded air, gas and moisture could be removed from oil if it is broken up into thin layers under practically absolute vacuum. Power-factor voltage curves with flat characteristics up to 300 volts per mil were obtained for compounds thus treated.

These results held good almost regardless of the type of compound, which proved definitely that the air, gas and moisture were the chief cause of trouble. The work of Davis and Eddy, also reported in *A.I.E.E. Transactions,* indicated that oil at atmospheric pressure will absorb air up to 10 or 15 per cent of its volume. This work connects Professor Dawes' results closely with the work of Emanuelli, Shanklin and Mackay and shows clearly that ionization would increase in direct proportion to the void volume in the cable. If, therefore, ionization is to be prevented, every precaution needs to be exercised to remove not only air but other gases and moisture.

Commercial adaptation of these important laboratory advancements was the extremely difficult problem which confronted manufacturers of paper cable. However, the new plant of the Anaconda Wire & Cable Company at Hastings-on-Hudson, N. Y., which has now been in operation nearly a year, represents the practical application of the most important features of the joint research conducted by the N.E.L.A. and A.E.I.C.



The newly developed equipment consists of a closed system which operates under extremely high vacuum (1 mm. absolute pressure or less), in which the cable core is dried and impregnated with degasified and dehydrated oil by means of oil pressure without the introduction of air or any other gases at any time. The salient features are:

(a) *The closed oil system,* which includes filters, degasifying apparatus, transfer pumps, impregnating tanks, accumulators and pumps, is all operated under 1 mm. absolute pressure and every pump and valve is provided with an oil seal.

(b) *The cable cores* are dried and impregnated under the 1-mm. vacuum followed by oil pressure.

(c) *The compound,* once placed in storage tanks, is never permitted to come in contact with air. It is filtered, dehydrated and degasified before it is used to impregnate cable. The same 1 mm. of absolute pressure is maintained on the compound in the storage tanks and impregnating tanks. Consequently no oxidation can take place.

(d) *Control* during the entire treatment is exercised by capacitance and power-factor measurements made possible by special electrodes connected with the interior of the impregnating tanks.

One of the most interesting and baffling problems encountered in development of the apparatus was the breathing of appreciable quantities of air directly through the metals at high vacua. The most effective of two possible solutions was developed by the application of special compounds to the metals to prevent breathing; this is obviously better than increasing the capacity of pumps, which would result in air contamination. A relatively small super-vacuum pump is therefore used to impress the sustained pressure of 1 mm. or less in the entire system. Coincident with the problem of tank walls, the development of metallic joints and gaskets required the utmost engineering technique to assure maintenance of vacuum.

In the operation of this high-vacuum equipment the compound is subject to the treatment which applies the first salient fact developed by organized research. Raw oil is filtered and then completely dehydrated

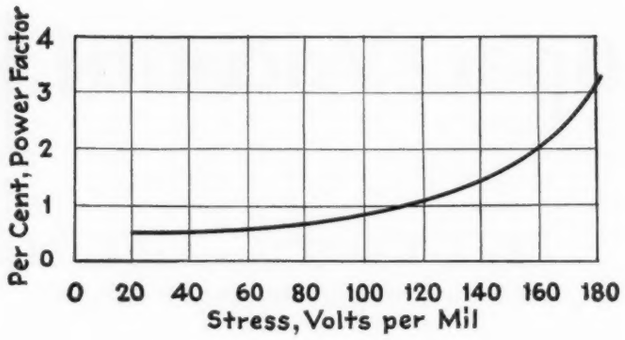
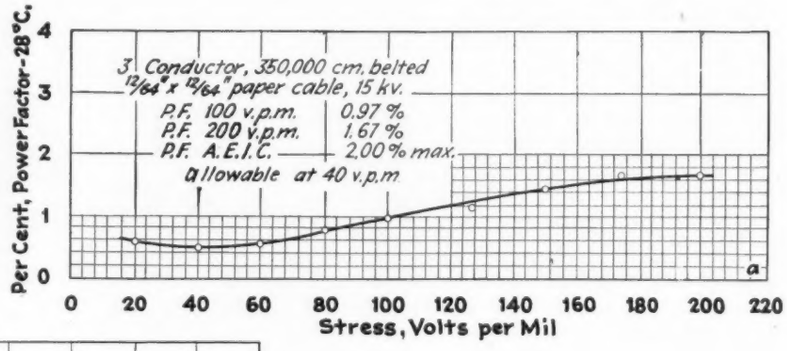
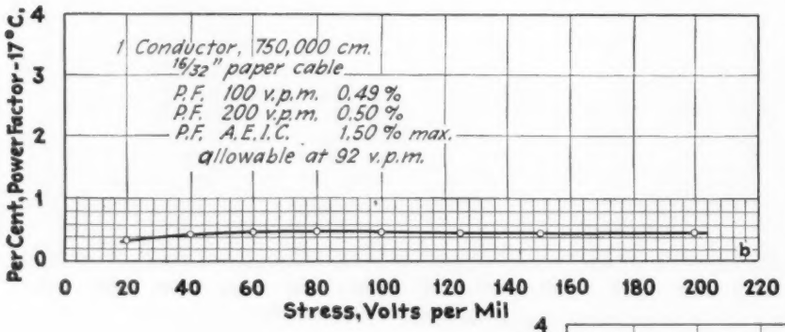


Fig. 3—Power factor of a cable not impregnated at high vacuum or with completely degasified compound

Ionization begins at 80 to 120 volts per mil.


Per Cent, Power Factor-28°C.
3 Conductor, 350,000 cm. belted
13/64" x 13/64" paper cable, 15 kv.
P.F. 100 v.p.m. 0.97 %
P.F. 200 v.p.m. 1.67 %
P.F. A.E.I.C. 2.00 % max.
allowable at 40 v.p.m.
a
0 1 2 3 4
0 20 40 60 80 100 120 140 160 180 200 220
Stress, Volts per Mil


Per Cent, Power Factor-17°C.
1 Conductor, 750,000 cm.
16/32" paper cable
P.F. 100 v.p.m. 0.49 %
P.F. 200 v.p.m. 0.50 %
P.F. A.E.I.C. 1.50 % max.
allowable at 92 v.p.m.
b
0 1 2 3 4
0 20 40 60 80 100 120 140 160 180 200 220
Stress, Volts per Mil

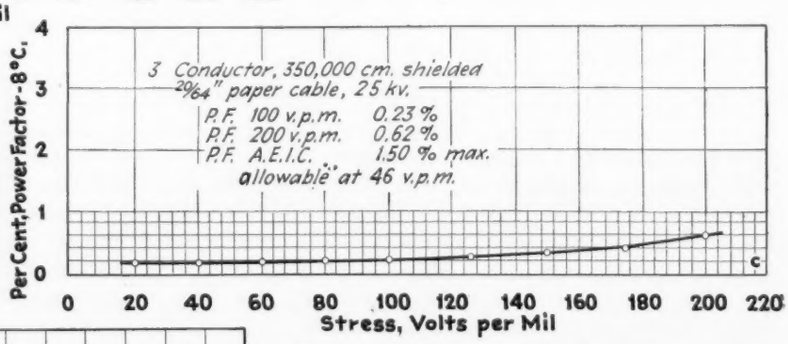
Figs. 4a, b and c — Factory results obtained with three types of cable by high-vacuum impregnation

All these data were taken on cable sections in regular production.

(a) Extremely flat characteristic obtained by high vacuum and use of degasified compound even in most difficult type of cable to impregnate. Note there is no ionization break even up to 200 volts per mil.

(b) With this heavily insulated cable the ionization voltage has been raised above 200 volts per mil.

(c) The power factor of this 25-kv. shielded cable at 20 and 100 volts per mil is about half that recorded for other cables by Electric Testing Laboratories in 1930. Even at 200 volts per mil the power factor is one-half the value allowed at 46 volts per mil by A.E.I.C. specification. Electric Testing Laboratories credits this cable with 17 to 20 per cent greater "one-hour life" than average cable.


Per Cent, Power Factor-8°C.
3 Conductor, 350,000 cm. shielded
20/64" paper cable, 25 kv.
P.F. 100 v.p.m. 0.23 %
P.F. 200 v.p.m. 0.62 %
P.F. A.E.I.C. 1.50 % max.
allowable at 46 v.p.m.
c
0 1 2 3 4
0 20 40 60 80 100 120 140 160 180 200 220
Stress, Volts per Mil

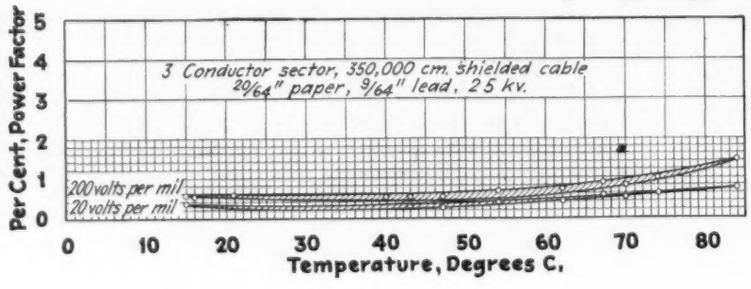

Per Cent, Power Factor
3 Conductor sector, 350,000 cm. shielded cable
20/64" paper, 9/64" lead, 25 kv.
200 volts per mil
20 volts per mil
0 1 2 3 4 5
0 10 20 30 40 50 60 70 80
Temperature, Degrees C.

Fig. 5—Maximum variations in power factor of high-vacuum impregnated cable during heat cycles

Even at 200 volts per mil and 84 deg. C. the power factor is still below the maximum allowed by A.E.I.C. specifications for 100 volts per mil and room temperature. Note the extremely small difference of power factor at 20 and 200 volts per mil. These data were taken during regular production and apply to same type of cable referred to in Fig. 4c.

and degasified by spraying into the vacuum chambers at a sustained vacuum at 1 mm. The oil thus purified, when used to impregnate cable, gives power-factor voltage stress curves identical with those obtained in the research laboratory. Fig. 1 illustrates the laboratory results obtained on three different compounds. The results obtained are equally good almost regardless of the type of compounds after the damaging occluded gases and moisture have been removed by the new process.

The unimpregnated paper cable core, after fabrication, is subjected to preliminary drying in modern ovens. Hot dry air is circulated by electric blowers until the moisture content is reduced to a very low value. The cable itself, during the first drying, stores up a predetermined quantity of heat, which aids in the super-drying process which is to follow. Electric cranes move the large metal cable reels from the drying ovens into the impregnating tanks. The heated and partially dried cable core is sealed in the impregnating tanks and immediately subjected to a vacuum which is reduced to 1 mm. or less by super-vacuum pumps. The combined action of stored heat and sustained vacuum superdries the cable. This dry-heat process is the practical application of another and equally important research development as outlined by Johns Hopkins research reports. The super-drying is controlled by power-factor measurements to determine constant characteristics before proceeding with successive steps.

These measurements within themselves are not necessarily significant. However, the real merits of the low vacua treatment are realized in the finished product, for not only are all voids completely filled but the paper is so highly impregnated that it cannot further absorb compounds later on, as do papers treated at lesser vacua.

Thus far the process has been described as applied to the treatment of the compound and cable core separately. It is now only necessary to combine these two separately prepared materials to gain the desired cumulative results. The treated oil is pumped under vacuum into the impregnating tank, being sprayed again into the sustained vacuum in which the cable core is sealed, until the tank is completely filled. Heat is constantly being applied during the impregnation by steam coils within the tanks and pressure is applied within the tanks by means of a pressure oil pump and an accumulator. Laboratory procedure is thus exceeded because no air or gases are introduced over the oil to produce the required pressure. Contact with contaminating elements is completely eliminated. The impregnation is continued until constant power-factor and capacitance characteristics are obtained, which assure complete filling. Fig. 2 represents the power factors obtained on laboratory test samples at Johns Hopkins for different degrees of vacuum treatment. Note the great importance of extremely low vacua.

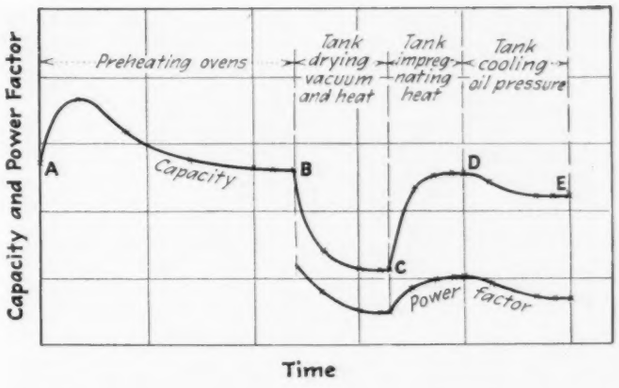
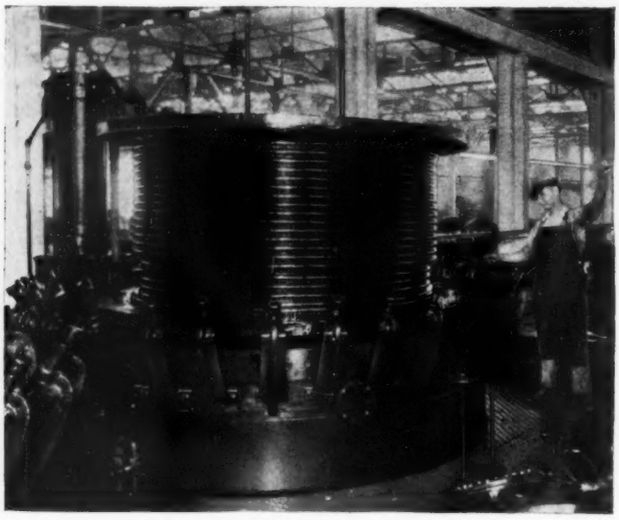


Fig. 6—Duration of each step of cable treatment determined by power factor

The power factor is checked by test circuits leading inside vacuum tank. Each step in the super-treatment process is brought to a tested unchanging condition (flat curve at B, C, D and E) before proceeding with next step. The testing is more frequent toward the end of each period. Such tests insure 100 per cent drying and impregnation.

High-vacuum impregnating tanks and compound dehydrators, filters and degasifiers

Air circulating blowers on two of the pr e-drying ovens are visible in foreground.



Impregnated cable being removed from tank

Note thick film of cooled compound which protects cable from absorption while being removed to cooling tank awaiting application of lead sheath.

The super-impregnated cable is at this stage thoroughly cooled, while still sealed in the impregnating tanks; the seal is then broken and the reels of cable, coated with a thick layer of cold compound, are transferred to the cold oil storage prior to lead covering. The temperature of the cable before removal and during storage is controlled at predetermined values to prevent any air or moisture penetration through the cold-protecting film of compound which surrounds the cable core.

The application of the lead sheath removes this heavy film of compound as the lead is contracted onto the cable core in the extrusion chamber of the lead press. The cable core as it then exists within the lead sheath has retained the extremely important qualities given to it by super-drying and super-impregnation for the purpose of increasing the ionization voltage up to values beyond 200 volts per mil.

This new cable plant of applied research has been in use since early this year, and cable with vastly improved characteristics as compared with the old type of cable is being obtained. Fig. 3 shows typical ionization characteristics of belted three-conductor cable made by the older processes. By contrast Figs. 4 a, b and c illustrate the unusual qualities of cable produced by the new process.

Repeated heating and cooling ionization cycles, to expand the oil and thus distort the cable and, if possible, alter its characteristics, are graphically shown in Fig. 5. Extremely flat characteristics and complete recovery after such test is significant of the high quality obtained by the new process. Cables made in this mill by the new process have been subjected to numerous long-life tests at the Electric Testing Laboratories and the mill laboratories at stresses up to 300 and 325 volts per mil. These tests have in no case revealed wax formation, ionization marks, dendritic designs, dried insulation or any other symptoms that usually indicate progressive deterioration.

Coincident with the development of machinery and equipment for application of research there have been installed at the Hastings plant modern high-speed wire drawing and stranding equipment, new paper-wrapping and cabling machines, a lead press equipped with special devices for controlling accurately the lead sheath thicknesses and extensive cable-testing facilities.

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Accident Statistics Should All Be on Same Basis

By W. R. TURNER
Director of Safety
Associated Gas & Electric System

To be able to compare accident statistics they must all be built upon the same kind of foundation.

"Lost-time accidents," "number of days lost," "number of days lost" allowed for a fatality or total disability, "total number of hours worked," "accident frequency" and "accident severity" cannot be compared with other figures for the same things unless all figures are arrived at in the same way.

What is a "lost-time accident"? Most companies allow only the day of the accident, but some companies allow one or two days' absence from the job before the accident is classified as a "lost-time accident."

What is a "lost day"? Some count "lost days" until the injured employee can resume his regular occupation, others allow employee to return to any beneficial occupation, and still others will bring in the injured employee when he is not able to do anything but sit or lie around, and will credit the accident with no "lost days."

An employee losing part of his thumb may get back to his regular occupation in sixty days, yet some authorities recommend charging such an accident with three hundred "lost days."

A story has been told of an industrial plant which had an infirmary. One of the employees broke his leg and

Guide for Monthly Accident Report

1. Number of "no lost-time" accidents.
2. Number of "lost-time" accidents.
   A "lost-time" accident is one in which the injured person does not return to a beneficial occupation on his or her regular working day following the accident.
3. Total number of accidents.
   Addition of Items Nos. 1 and 2.
4. Number of days lost.
   Start with first regular day after day of accident and include all calendar days disabled. Includes days carried over from previous months' accidents.
5. *Accident frequency (lost-time accidents)
   $= \frac{\text{Number of lost-time accidents} \times 1{,}000{,}000}{\text{Total number of hours worked}}$
6. *Accident severity (less fatalities)
   $= \frac{\text{Number of days lost} \times 1{,}000}{\text{Total number hours worked}}$
7. *Accident severity (including fatalities)
   Fatality or total disability = 6,000 days lost, minus any days already charged against accident.
8. Number of fatalities.
9. Number of employees.
   Number of employees on payroll on 15th of month.
10. Total number of hours worked.
    Number of employees on payroll on 15th of month × days in month, excluding Sundays, × 9 hours per day.
11. Per cent lost-time accidents per employee.
    $\frac{\text{Number of "lost-time" accidents} \times 100}{\text{Number of employees}}$

**The "frequency" and "severity" formulas are from the National Safety Council, Safe Practices pamphlet No. 21.*

every day during his convalescence the ambulance brought him into the plant, where he lay all day in the infirmary bed, and at the close of day he was returned to his home. This was done in order that the plant could have a good accident record. This story may or may not be true, but it emphasizes the point that foolish extremes are sometimes gone to so that the accident report can be made to look good. We are just kidding ourselves when we do such things.

How many "days lost" should be counted for a fatality or total disability? Again we have a difference of opinion which may vary from 300 to 6,000 days.

What is the "total number of hours worked"? This is a thing that has to be estimated in most cases. In some departments of a company the employees are paid time and a half for overtime, and on special days they receive double time. An employee might work eight hours on Sunday and the time book would have a record of sixteen hours, or an employee working on a monthly basis might work overtime several days a month and the records would show only eight hours per day. In trying to make allowances for holidays, when computing the days worked, we are up against the fact that outside of the five major holidays—Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas—different companies and different localities have a few of their own particular holidays; some more and some less. Therefore, an honest comparison cannot be made if each company arrives at its "total hours worked" by a method of its own. A fair estimate of the approximate total hours worked by all the employees will be as near correct as the totaling of the figures in the time books.

Because of the lack of any satisfactory existing uniform way of compiling accident statistics, several of the safety engineers and safety directors of the Associated Gas & Electric System met at Reading, Pa., in the fall of 1929 and agreed upon details, which resulted in the adoption of the form illustrated on the previous page.

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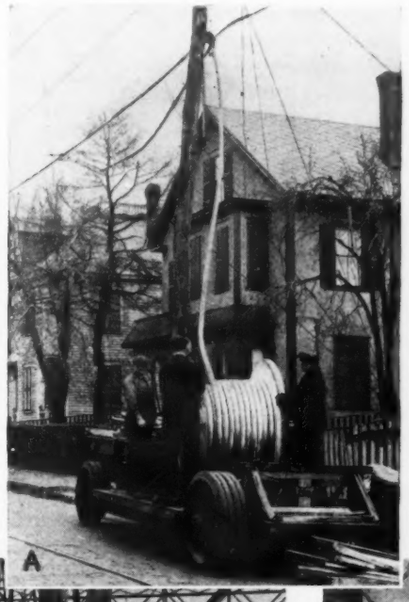
Heavy Construction Speeded Up

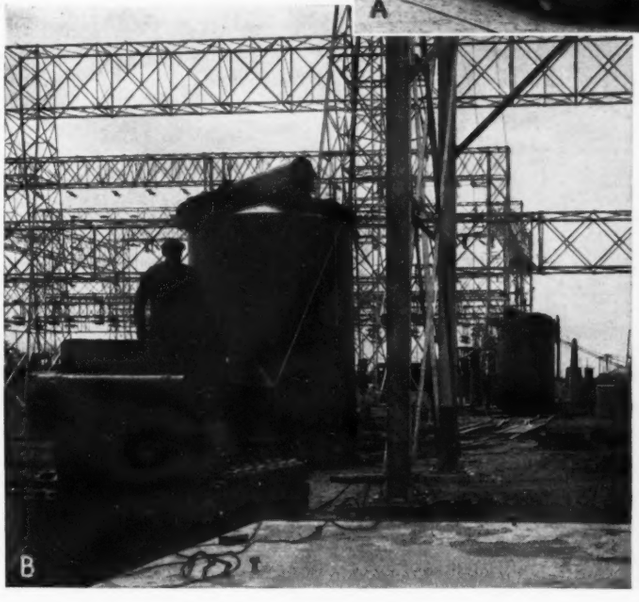


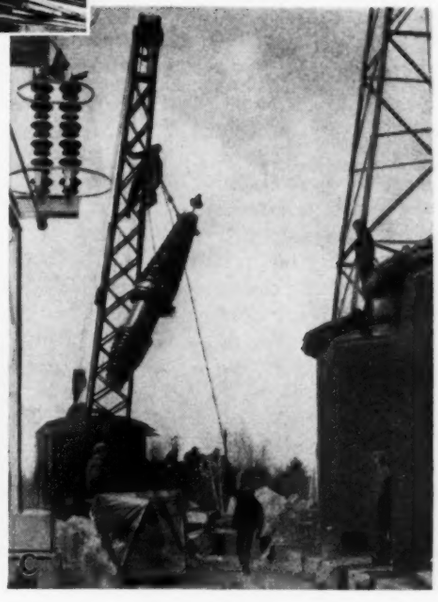
Construction work on the system of the New England Power Association is kept on schedule by organizing and directing field activities to utilize men and machinery to maximum advantage. The power-driven tractor, steam crane and gasoline truck each played an important part in transmission, substation and distribution activities in connection with the advent of 220-volt hydro-electric energy from the recently completed Fifteen-Mile Falls development.

(A) Cable pulled overhead from transportation truck.

(B) Breaker tanks readily moved by caterpillar tractor.

(C) Bushing of oil-filled type swung in position by crane.





Furnace Converts Scrap Into High Test Cast Iron*

By CARL H. MORKEN
Foundry Engineer Detroit Electric Furnace Company

Uniformly good, high test gray iron can be produced from scrap materials of low market value without the use of expensive alloying elements by the rocking type, indirect arc, electric furnace. With this furnace the foundry man can produce readily machinable castings possessing an ultimate tensile strength of 50,000 lb. per square inch or more and can be sure of obtaining the type of iron he desires without the aid of highly trained metallurgical men. Iron borings and inexpensive steel scrap can be converted into excellent high test gray iron at a cost below cupola operation. Cupola iron can also be processed to obtain an iron of higher quality.

The metallurgical advantages of the rocking action of this type of furnace in the production of high test iron are that no part of the refractory lining of the furnace is subjected to excessive heat by sustained exposure to the direct radiation of the arc; uniformity of composition and temperature are insured by the rocking action, and this action induces complete solution of the carbon, rapidly degasifies the metal, increases the strength of the iron and decreases its sulphur content.

The rocking type of electric furnace utilizes three principal methods for the production of high test gray iron. These are straight cold melting of various charges, duplexing cupola iron, or the triplexing process. In the duplexing process the charge is melted in the cupola and transferred to the electric furnace for further treatment. Triplexing may be defined as that process of producing high cast gray iron wherein low quality cupola iron and additions of cold materials are processed in the electric furnace. The cost of these various methods for the electric furnace are given in the accompanying tables.

The data in these tables apply to the Detroit rocking electric furnace of the indirect arc type. This furnace employs both radiation and conduction in the heat transfer. It is a horizontal drum, in effect, set upon a suitable base, with the electrodes entering at the axis. The shell is entirely lined with refractory metal and contains only three openings, the two electrode ports and the charging door. Pouring is done from a spout immediately below the door opening. The rocking action of the furnace is controlled by mechanical means, and the direction of rotation is reversed automatically at three determined points, which are adjustable. Only two electrodes are used, since the furnace is operated on single phase.

Abstract of paper on "The Detroit Rocking Electric Furnace as Applied to the Production of High Test Gray Iron," presented at the recent meeting of the American Electrochemical Society.

Cost of Triplexed Iron in Ladles

	Quantity, per Cent	Base Price	Cost per Ton, Poured
Iron borings	20	$7.00	$1.40
Steel scrap	8	$12.50	$1.00
Cupola metal	72	$23.00	$16.56
Total metal cost per ton			$18.96
Triplexing cost per ton			4.71
Total cost triplexed iron			$23.67

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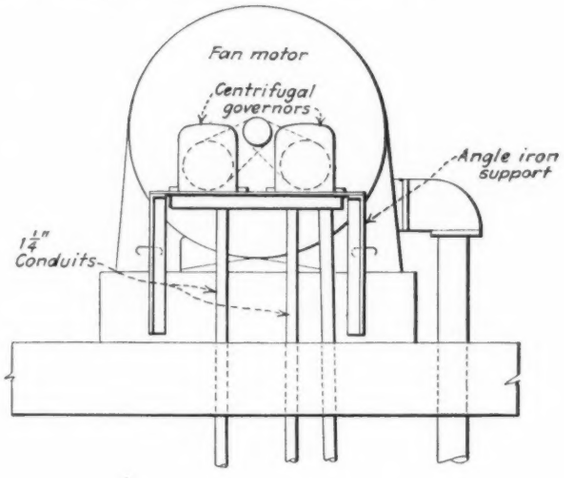
Centrifugal Draft-Fan Control



Centrifugal switches or governors are belted to the motor shafts driving the draft fans at the Powerton station of the Super-Power Company of Illinois. The multi-speed squirrel-cage motors introduce a reversal of stresses in the fan and motor rotors if the speed at the motor is changed before the rotors have slowed down to approximately the lower speed. One of the centrifugal switches delays the operation at the speed-changing switch until the lower speed is reached. The other switch serves to shut down certain auxiliaries in case the fan speed drops below a predetermined level.

Electric Melting Costs

Borings	Cost per Ton
Power, 540 kw.-hr.	$6.75
Electrodes	1.60
Refractories	1.50
Labor	1.00
Conversion cost per ton charged	$10.85
Value of borings (average)	7.00
Total cost per ton charged	$17.85
Recovery, 97 per cent	
Total cost per ton poured	$18.40

Synthetic Gray Iron	Cost per Ton
Power, 600 kw.-hr.	$7.50
Electrodes	1.80
Refractories	1.50
Labor	1.25
Conversion cost per ton charged	$12.05
Value of steel scrap	8.00
Total cost per ton charged	$20.05
Recovery, 99 per cent.	
Total cost per ton poured	$20.25

Duplexing Cupola Iron	Cost per Ton
Power, 100 kw.-hr.	$1.25
Electrodes	0.35
Refractories	0.30
Labor	0.20
Total cost per ton	$2.10

Designing Insulators to Combat Fog

By S. MURRAY JONES
Ohio Brass Company, Mansfield, Ohio

Deposits are the primary cause and fog itself only secondary cause of breakdown.

Surface leakage resistance is the real criterion of performance.

Some designs have led to overstress at drip points.

Adaptation of pin design to insulator use is sometimes helpful.

"Fog design" does not eliminate necessity for cleaning periodically.

OPERATING companies as well as manufacturers are still developing insulators of the so-called "fog type." Locations in which "fog types" have been tried are mainly along the seacoast where transmission line troubles and interruptions have occurred owing to salt spray deposits. Such troubles may occur as far as 25 miles inland, although they diminish rapidly as the line leaves the seacoast. Most outages from salt spray and other contaminating elements occur either during the night or in the early morning hours at the time of fogs. There is, accordingly, a common belief that the troubles are due principally to the fog. Tests and operating data indicate, however, that fog is only a secondary cause of these troubles. In fact, the use of the term "fog type" is wrong, since in most cases the troubles are not primarily due to fogs, but to contamination.

In most instances salt spray and fogs, fumes and foreign substances develop no unusual depreciation of insulator glaze or porcelain, but they do decrease the effective resistance of the path over the insulators and accordingly decrease their surface leakage resistance. Most deposits of salt or other foreign substances are of a hydroscopic and porous structure which facilitates condensation. Because of this fact the accumulation is rather rapid when once started. The result of this is that the wet flashover value is reduced materially. The reason for the reduction in flashover value is evident, since salt water, chemical solutions, etc., are much better conductors than ordinary rain water and shunt out certain portions of the porcelain, decreasing the effective length of insulation and consequently reducing the surface leakage resistance. This also tends to make an arc that clings to the surface of the insulator rather than the desirable "free arc" away from the porcelain surface, as is the case with a clean unit of proper design. The dry flashover value at low humidities is not very different for clean or dirty units. At high humidities, especially those approaching saturation or fog conditions, the reduction is considerable, as shown in Fig. 1.

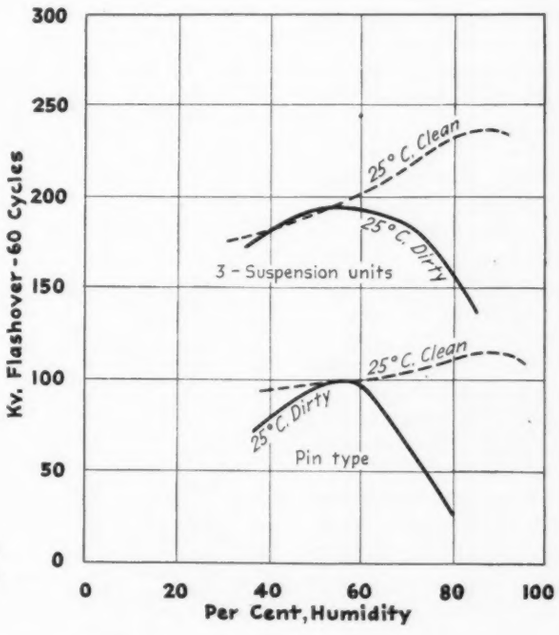


Fig. 1—Humidity accentuates weakness of dirty insulators

Various methods of comparing different insulators to determine their adaptability under conditions of fog and dirt have been attempted. Most of these have neglected to take into consideration all of the important factors. Engineers frequently use the leakage distance of different insulators or the surface area of the porcelain, combined with the guaranteed flashover values—wet and dry—as a basis for comparison. These factors do not consider the complete insulator characteristics. As the surface of an insulator becomes moist or contaminated flashover voltage is reduced. This is due to a change in the surface resistance and the electrostatic capacity. In most designs the electrostatic capacity is affected only slightly and the increased leakage current and reduction in flashover voltage are due to

the decrease in surface resistance. If the width were constant, then the resistance would be equal to the specific resistance of a unit length, times the length or leakage distance; however, in practically all insulators the width is not constant.

Assuming the exposed porcelain surface to have a constant specific resistance per inch square and to be equivalent to an infinite number of small resistances, then the surface leakage resistance may be defined as the

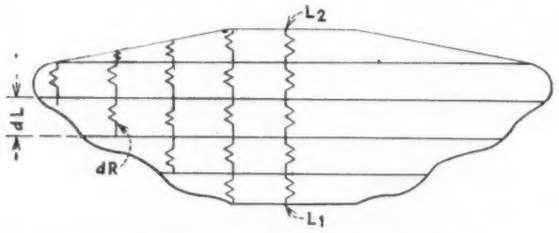


Fig. 2—Width of leakage path must be considered

The surface of any insulator, either pin-type or suspension, has an appreciable width of porcelain in comparison with the length of leakage path. The surface leakage resistance is composed of a multiplicity of paths in series and parallel.

summation of these resistances from cap or tie wire groove to pin of a single insulator.

The exact equation has been obtained for a typical 10-in. suspension unit and the surface leakage resistance as obtained from it checked against an approximate method. The values obtained from the approximate method were within 3.5 per cent of those using the true equation; consequently, since errors in obtaining insulator dimensions and manufacturing tolerances are within this limit, the approximate method suffices for a comparison.

Suspension string length a factor

This method of comparison is usually sufficient for pin-type insulators, but for suspension units another factor is quite essential. The string length or section length (S in Fig. 3) is important, since it is desired to obtain the maximum insulation in a given space, thus making tower heights a minimum. Consequently, for suspension units the surface leakage resistance per inch of section length should be used.

The operating engineer, in addition to obtaining the maximum amount of insulation, or surface leakage resistance, is interested in its cost. Thus for pin-type insulators the practical basis of comparison is: Surface leakage resistance $\div$ cost of insulator, and for suspension insulators: Surface leakage resistance $\div$ (section length $\times$ cost of insulator).

These factors and methods of comparing insulators all assume that the insulator, when suspended in air, will flash over rather than puncture. Most insulators of good design will do this, but if not, then another factor, the thickness of the dielectric, must be used.

In addition to surface leakage resistance, comparisons of other factors must be considered, particularly the design characteristics and their suitability for the particular contaminating condition. Their general design must also be considered, since in some instances insulators with deeply grooved sections have been designed (similar to Fig. 4), which, when improperly proportioned, may produce overstress at the edges, when either clean or dirty, thus reducing the flashover value. Overstressing of insulators is also a source of radio troubles. The necessity of eliminating and reducing overstress, particularly on fog-type units, is important, since tests on charged and uncharged insulators subjected to dirt or other foreign substances indicate that a charged insulator becomes dirty much more rapidly than an uncharged one, the tendency being to accumulate deposits at points of overstress or points of strongest electrostatic field. One author has attributed the reason for the more rapid accumulation at the point of overstress as being due to the electrical wind. It has long been known that certain chemical processes made use of electrostatic precipitation to remove impurities from the air and break them down into nitrous solutions forming a strongly adhesive substance which cannot be removed by washing and ordinary cleaning methods, steel wool being necessary in some cases.

On the higher-voltage pin-type lines a satisfactory solution for fog troubles may be obtained by increasing the amount of insulation through changing the line to suspension insulator construction. Where, because of limited clearances, conversion to suspension units is impossible, the use of an assembly of two pin types in tandem might solve the problem. Pin-type design, and consequently tandems, if properly designed, have longer leakage paths and more surface leakage resistance per inch of height than suspensions per inch of section length. For the lower-voltage lines certain insulators, commonly referred to as "cement-hood" types (shown in Fig. 5), are in most cases satisfactory.

As has been previously mentioned, the voltage per unit has a considerable effect on the surface deposit; therefore, on suspension lines with relatively short strings the short-spaced $4\frac{3}{4}$-in. or 5-in. unit is of par-

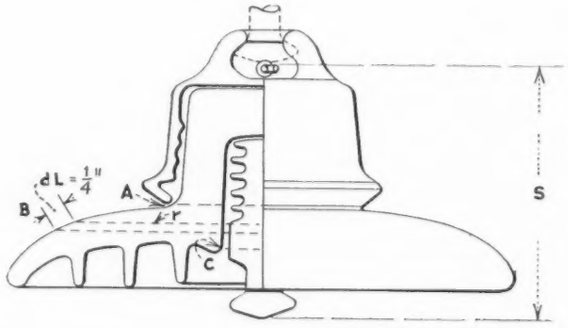


Fig. 3—Computing surface leakage resistance

The surface leakage resistance of an insulator may be obtained approximately from a full-scale print showing the cross-section of the insulator.

The leakage distance ABC should be marked off in $\frac{1}{4}$-in. sections and the radius measured at each of these points. The surface leakage resistance of the entire unit is therefore the summation of the resistances of each of the $\frac{1}{4}$-in. sections. If the specific resistance is assumed to be the same for all insulators and the leakage distance for each of them to be compared is divided in $\frac{1}{4}$-in. divisions, then the surface leakage resistance factor is the sum of the reciprocals of the radii measured at each $\frac{1}{4}$-in. division of the leakage distance.

If a table of reciprocals is available, the summation becomes relatively simple, the radii being measured from a print and tabulated, the reciprocals obtained from the table and added together.

ticular advantage, owing to the lower unit stress on individual insulators when compared on a string length basis. Also, it will be found that the surface leakage resistance per insulator string for strings of the same length of long- or short-spaced units will show higher values for the short-spaced units.

Adapting pin design to suspension use

Where clearances are limited a pin-type unit converted for suspension operation, such as is shown in Fig. 6, has in many cases proved to be satisfactory.

A string made up of the units shown in Fig. 6 will provide a maximum surface resistance and leakage path per inch of string length and is constructed so that drip

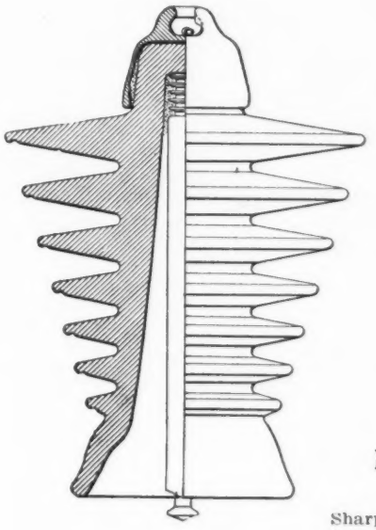


Fig. 4—An example of overstressed insulator

Sharp edges and drip grooves result in overstress, flashover and radio interference.

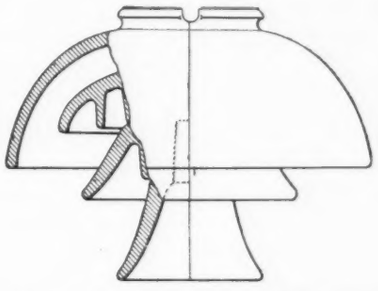


Fig. 5—Cement-hood fog-type insulator for lower voltage

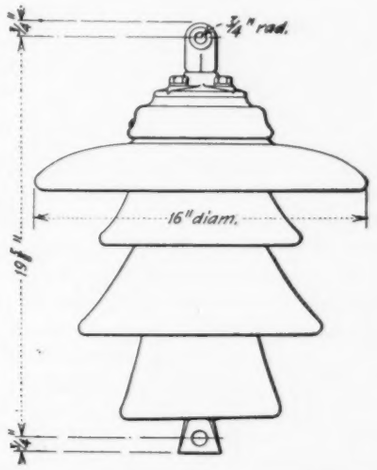


Fig. 6 — Pin-type insulator converted to suspension form to meet fog conditions

water does not short-circuit any sections of the insulator —a common occurrence in some of the present corrugated types.

Where long strings of suspension units are used, as on the higher-voltage lines, flashovers may occur from fog alone. Where dense fogs exist it may be that the units are wet and dripping water most of the time. In such cases the wet flashover of the string may be increased by breaking up the drip water through inserting a few units of larger diameter, mixing them in the string.

Quite naturally, the production of specially designed insulators is relatively low when compared to that of the standard 10-in. disk. Consequently, the cost of such units is high when compared on a unit basis or per inch of leakage distance or surface leakage resistance.

An engineering comparison indicates that the most insulation, as measured by surface leakage resistance, per dollar of investment can be obtained by the use of the standard short-spaced 10-in. disk, there being a few exceptions for special locations.

Cleaning period depends on conditions

The length of time which it takes for a damaging deposit to take place on insulators is so variable and so dependent on the location of the insulators and the contaminating substances that no definite rule can be given for cleaning them. This previous statement intimates that cleaning is necessary, and most operating companies have found that they cannot economically install sufficient insulation at some locations to reduce flashovers to a minimum without incurring the necessity of periodic cleaning. In every case there is an economic balance to be found between the cost of additional insulation and a reduced number of cleaning periods and the cost of reduced insulation and an increased number of cleaning periods.

In cases where the deposit is not especially adhesive and a water of high resistance is available, cleaning may be done from an ordinary hose with the lines energized. Where this is possible, a heavy stream of water is necessary. A small stream of water would merely tend to wash the particles to one portion of the porcelain surface and might produce a flashover by concentrating the foreign particles in a line at the edge of the stream.

Most cleaning must be done with the line or equipment dead, and the insulation must be carefully wiped to prevent a residue of particles along certain portions of the insulation which will cause flashover when the circuit is recharged.

Here is an example of the difference in practices of operating companies in cleaning insulators: One company has established a routine of cleaning its units once a year. It uses a combination of No. 2 steel wool and rags for cleaning, which is done with the line dead. Another company has used carbon-tetrachloride with success. A company on the Eastern seaboard, a good many of whose lines traverse salt marshes and are subjected to smoke and chemical fumes, makes a practice of cleaning suspension insulators every three months.

In most cases, owing to the better protection of station apparatus, it is necessary only to clean such insulators perhaps half as often as line insulators. Where the reverse is true, installations using spray nozzles effectively placed have been made. This permits a rigid washing schedule without interference with operation.

One investigator who has done considerable valuable testing of various proposed fog types concludes that

"there is no virtue in any particular shape or design except as it provides surface leakage resistance."* In addition, it is well to remember that the design should be considered and studied to determine the possibility of overstress during normal or abnormal operating conditions. Assuming that the units would not overstress, perhaps a better yardstick to measure the insulation would be the value of surface leakage resistance per inch of insulator section length, per dollar investment.

With the application of special units or additional insulation on lines or buses, particular attention must be given to provide proper lightning arresters, or protective gaps, to prevent damage to station transformers and other station apparatus.

Other factors should be considered equally in the proportioning of insulation or location of lightning arresters or protective gaps. The type of suspension insulator is important. The advantages of the short-section length, 10-in. diameter, ball-and-socket type, are several. There is less tendency for corona discharges from sharp corners and points, which may occur on other designs such as clevis units or units with longer section length but with no increase in diameter. The ball-and-socket unit, being rotatable, where the clevis is not, certainly has the advantage where cleaning must be done.

The selection of proper hardware is important. It must be free from corrosion and of such design that corona discharges are a minimum and voltage grading effect on the string a maximum. Poorly designed clamps having points facilitating corona formation not only reduce the flashover value of the string but because of the electric wind effect will attract foreign particles to them and to the insulators. Corona streamers from cotter keys and pins and other points of high stress are a constant source of radio interference. In some localities this has been a real consideration in the selection of insulation.

In general, then, the recommendations are to provide additional insulation in locations which are subject to salt spray, fogs and conditions of dirt, using on pin-type lines either tandem assemblies of standard pin-type units or those of the cement-hood type, and using close-spaced units on the medium- and high-vlotage suspension lines (the number of units to be determined experimentally from operating practice) and in some instances mixed strings of large and standard 10-in. diameter suspension units.

*R. J. C. Wood, "A.I.E.E. Journal," December, 1929.

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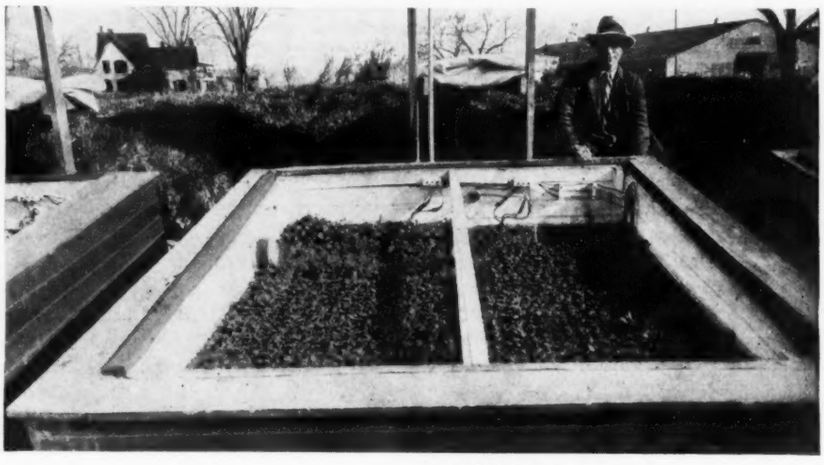
Electricity Heats Hotbeds Economically

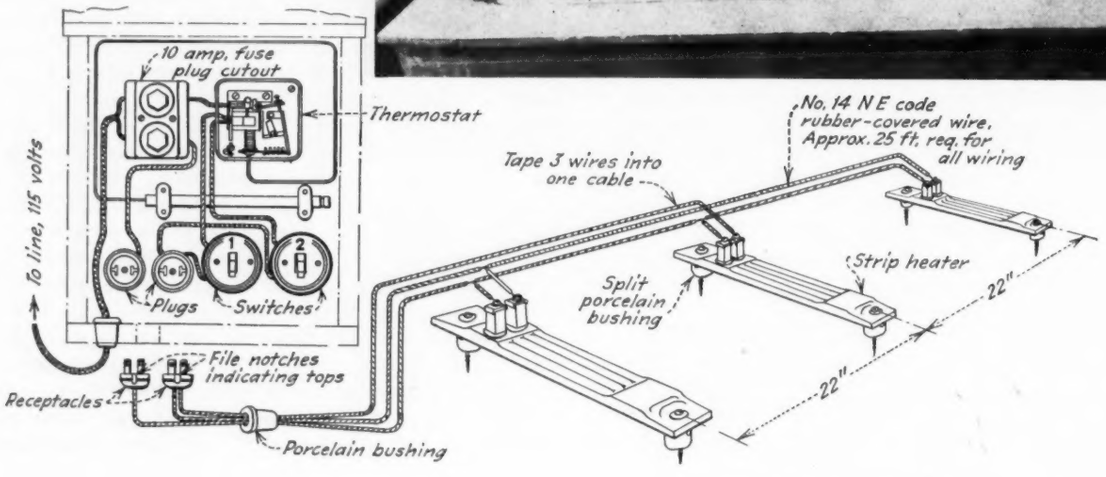
By E. W. PILGRIM and C. N. MOORE
Industrial Engineering Department and Research Laboratory, General Electric Company, Schenectady, N. Y.

Practical, economical and convenient heating of hotbeds for the stimulation of plant growth can be effected by the use of electric heating elements in specially designed frames. The electric hotbed maintains a uniform temperature throughout the growing season, and when a cold frame is desired, it is obtained simply by turning off the electric current.



Electricity proves practical and economical for heating hotbeds

One of three electrically heated hotbeds on the General Electric test farms at Schenectady which operates on 2.2 kw.-hr. per day. Diagram shows electrical layout. The heaters each have a 62½-watt capacity.



Three electric hotbeds which have given satisfactory service on a test farm in New York State are designed for operation on a 115-volt circuit and have three 62.5-watt strip heaters. These units are wired in two circuits, one of 62½ watts and the other of 125 watts, and three heats are obtained by using either circuit separately or both together.

The hotbeds are of double-walled construction with cinder insulation. The electric heating elements are located in an air chamber in the base and are mounted on boards which are hinged together so that they can readily be removed for inspection, or for storage when the bed is not in operation.

Temperature regulation is obtained automatically with a thermostat. This thermostat has a capacity of 10 amp. on a 115-volt circuit and can be used to control any number of hotbeds up to this capacity. The thermostat can be omitted and the beds operated manually.

Tests showed that the hotbed, measuring 3x6 ft., had an average energy consumption of 2.2 kw.-hr. per day for a seven-week period in March and April. During this time the air and soil in the hotbeds were maintained at a suitable temperature for the rapid germination of seeds and the growth of plants.

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Farm Project Water Heaters Join Electric and Sun Energy

By GEORGE W. KABLE

Director National Rural Electric Project, College Park, Md.

On the average dairy, milking from ten to 30 or 40 cows, milking and "cleaning up" is a morning and night chore which can be made less burdensome by the elimination of the old-fashioned steam boiler for supplying the fairly large quantities of hot water demanded if city health department and milk distributors' requirements are to be met.

While a number of electric heaters have been devised and are quite satisfactory, except that the cost of electricity may be greater than the coal bill where no special water heating rate is in effect, it has proved desirable to introduce a supplementary sun heater to keep down costs.

A supplemental solar water heater has been installed on the Seibel dairy farm of the National Rural Electric Project with highly satisfactory results. This consists essentially of an absorber located on the roof of the milk house and of a ⅙-hp. motor-driven circulating pump inside the building. The pump takes water from the bottom of the 10-gal. insulated tank and pumps it through the absorber and back into the top of the tank. The tank is a commercial electrically heated unit which has been in use for some months. A bimetallic thermostat which is located in the absorber housing controls the circulating motor, causing it to pump water through the absorber only when the sun's heat is above a predetermined point.

The absorber is made of ⅜-in. copper tubing soldered to a finplate consisting of a sheet of corrugated iron. The metal is painted a dull black and is housed in a glass-covered "hot-bed" oriented toward the sun.

During the warm days of the summer at the latitude of Washington 10 gal. of water has been heated from 65 deg. F. to 150 deg. F. in a few hours by the sun with this system. In October the water in the absorber gets up to about 100 deg., but by restricting the flow it is possible to have water returning from the absorber at temperatures approaching 200 deg. F. The electric heater is used to complete the heating of the water to the desired temperature.

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READERS' FORUM

Chlorination Prevents Condenser Fouling

To the Editor of the ELECTRICAL WORLD:

Our attention has been called to an article entitled "Chlorination Prevents Slime Fouling of Condensers" on page 906 of the November 15, 1930, issue of the ELECTRICAL WORLD.

We have had inquiries from a number of people regarding this article who have apparently obtained the impression that the conclusions stated at the end of the article are based upon the work of the Public Service Electric & Gas Company, whereas the statements are actually the conclusions in the report of the work done by the Northern Indiana Public Service Company.

M. PENN,

General Superintendent of Generation, Electric Department, Public Service Electric & Gas Company, Newark, N. J.

[The statement in the ELECTRICAL WORLD which Mr. Penn declares is incorrect was due to a misinterpretation of the Great Lakes N.E.L.A. prime movers report, for 1929-1930, excerpt from which follows verbatim. —Ed.]

In the report of Messrs. V. M. Frost and W. F. Rippe of the Public Service Electric & Gas Company, on "Experience in Chlorinating Condenser Circulating Water," part three of the new installation for No. 3 condenser is as follows: "The chlorinator injects the solution continuously into the tower filled with limestone and the pump operates intermittently taking solution from the tower and pumping it into the canal." This process would be similar to the bleaching powder or the calcium hypo-chloride solution processes. Substitution of bleaching powder eliminates some of the most serious objections against using chlorine gas which are: (1) Hazard, (2) Maintenance of equipment. (3) Elimination of separate building for chlorinating equipment.

This investigation brought out the following:

1. That slime adhesion to condenser tubes can be prevented by chlorination.
2. Chlorination results with depositing of a hard scale on condenser tubes which must be removed by cleaning by other means than rubber plugs.
3. When circulating water is treated with bleaching powder there is not as much scale deposit on the tubes as with chlorine-gas treatment.
4. Chlorination does not cause corrosion or excessive loss on weight of condenser tubes.
5. Uniform absolute pressure close to standard performance can be maintained with much less total cost of tube cleaning.

BOOK REVIEWS

Experimental Electricity

By Ralph H. Walters. New York: McGraw-Hill Book Company, Inc. 145 pages. Price, $1.50.

A manual of experiments in direct- and alternating-current electricity for the use of students who desire to enter occupations in the electrical field on the semi-professional level. It comprises a brief course for men of limited time, means or analytical interest who do not intend to complete a professional course in engineering.

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Die Asynchronen Wechselfeldmotoren

By Prof.-Dr. Gustav Benischke. Berlin: Julius Springer. 123 pages, 109 illustrations.

Motors with an alternating field are the subject of this book, now in its second edition, by an author who has made numerous contributions to technical literature. This limitation of the subject bars synchronous machines. Most of the attention is given to commutator motors, series and repulsion; only the last portion of the book deals with induction motors. The treatment is purely theoretical, in the sense that specific design or operating data are not considered, but is mathematically simple, suitable for undergraduate use in a technical school. The author finds it quite unnecessary to resort to the usual expedient of making the stationary alternating field consist of two imaginaary oppositely rotating fields, but builds up the analysis directly on the physical fact of a single field that changes in intensity.

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Foundations for Human Engineering

By Charles R. Gow. New York: The Macmillan Company. 226 pages, illustrated.

This is a delightful series of lectures delivered to students at Massachusetts Institute covering the human aspects of engineering life. There is a flavor and a style in the talks that should captivate old as well as young engineers. Fundamental character traits are treated with keen psychological understanding.

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American Industry and Commerce

By Edward Dana Durand. Boston: Ginn & Company. 653 pages, numerous diagrams. Price, $4.

In order to understand the present growth and status of American commerce and industry, it is necessary to view it as a whole. Every well-informed business and professional man has a more or less definite understanding of this status as far as his own particular calling is concerned, but the broader view requires exceptional familiarity with the great mass of data available, a philosophical mind well stored with a knowledge of history and of social changes, coupled with trained skill in analysis and presentation.

Doctor Durand possesses these qualifications. In his book he presents a carefully co-ordinated picture of our national progress in economic well-being. He tells a story based on statistics without parading tables of figures. He needs no blatant adjectives to make us aware of our country's impressive progress in the past and its promising future. Special stress has been laid upon international comparisons, upon the inter-relations of various economic activities and upon the general course of recent economic developments.

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Rechtsgrundlagen der Oeffentlichen Elektrizitäts-wirtschaft in Deutschland

By Ernst Henke, Dr.-jur. Hans Müller, Dr.-jur. Fritz Rumpf. Berlin: Julius Springer. 238 pages. Price, 14.50 reichsmarks.

In all countries the extraordinary development of the electric light and power industry has brought with it a steadily increasing series of legal problems. Lawyers by profession, responsibly connected with great German utility undertakings, the co-authors have undertaken to codify the prevailing legal aspects relating to the public supply of electrical energy in Germany. They state that the present work is to be regarded as nothing more than a modest beginning in this field. Nevertheless it should go far toward clarifying situations in which court rulings need to be guided by comprehension of the economic objectives toward which technical progress aims. In that sense, though dealing with conditions and therefore involving legal practice and tradition in one country only, it is of wider interest and application.

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Wave Mechanics

By Arnold Sommerfeld. New York: E. P. Dutton & Company. 304 pages, illustrated. Price, $6.25.

A survey of modern conception of the atom and atomic theory. The achievements of De Broglie, Heisenberg, Schrodinger and Dirac are narrated and the present situation is thoroughly presented. Fundamental and technical treatment is retained throughout the work.

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Relais und Schutzschaltungen in Elektrischen Kraftwerken und Netzen

By R. Rüdenberg. Berlin: Julius Springer. 281 pages, 336 illustrations. Price, 25.50 reichsmarks.

There is a field in technical literature for books that describe the principles on which certain electrical apparatus operates, and that set forth its place in the general scheme, without going deeply into details of construction or developing the subject mathematically. The present book is in that class. Its object is to give the kind of information on relays required by power engineers who have no occasion to be relay specialists. It embodies the substance of a series of lectures delivered at the Berlin College of Technology by several authorities in this particular field, now put into permanent form under the editorship of Dr. Rüdenberg. The relay has become an element of extraordinary importance in modern practice; the reader who wants a readable description telling how it works and what it will do will welcome this volume, and will, incidentally, find quite a bit of information on the circuit and equipment failures that make protection necessary.

Men of the Industry

C. E. Skinner Nominated for A.I.E.E. Presidency

DR. CHARLES E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Company since 1922, has been nominated for the office of president of the American Institute of Electrical Engineers.

Dr. Skinner is well known in the electrical industry for his engineering accomplishments, especially in the field of research.

In 1890 he joined the Westinghouse Electric & Manufacturing Company and the following year he undertook the development of a system for the testing of insulation, which required the development of testing apparatus and testing methods, and later he was put in charge of all insulation design, as well as testing. In addition to the insulation work, he took up magnetic testing and the development of magnetic materials in 1892 and retained charge of this work for many years. In 1906 Dr. Skinner organized the research division of the engineering department and was responsible for the organization and equipment of the chemical, physical and process laboratories, as well as the high-tension test laboratory. Through his efforts a laboratory for more fundamental research was determined upon in 1915 and he had charge of the building, equipping and organization of the personnel of this laboratory. In 1920 he was made manager of the research department and in 1922 he was made assistant director of engineering.

Dr. Skinner has been a delegate of the American Institute of Electrical Engineers and other organizations to various conferences and meetings abroad, including those of the International Electrotechnical Commission, the World Power Conference in London in 1924 and the World Engineering Congress in Tokyo in 1929. Dr. Skinner is a member of the board of directors of the American Standards Association. He was elected chairman of the committee on organization of the International Standards Association and represented the United States at the London conference of the I.S.A. in 1926. He is a fellow of the American Institute of Electrical Engineers and has served as manager and vice-president and as a member of the following committees: Edison medal, executive, public policy, code of principles of professional conduct, meetings and papers, standards, electrical machinery, electrophysics, education, and research. He is a member of many other organizations, including the Franklin Institute, American Society for Testing Materials, American Association for the Advancement of Science, American Society of Mechanical Engineers, American Physical Society, American Electrochemical Society, American Engineering Council, United States Committee of the International Electrotechnical Commission.

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PAUL A. SCHOELLKOPF, president of the Niagara Hudson Power Corporation, sailed for Europe, December 12, aboard the *Ile de France*.

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E. J. INGRAM has been appointed lighting engineer of the Public Service Company of Northern Illinois and W. S. E. MILLER has been named assistant illuminating engineer.

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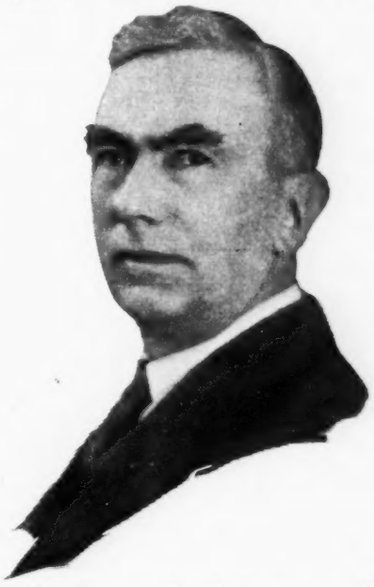
HARRY C. KNIGHT, president of the Southern New England Telephone Company, New Haven, Conn., was elected president of the New England Council at the recent annual business meeting at Hartford. Mr. Knight is a native of Maine, was educated at Bowdoin College and entered the communication field in 1902. He became commercial superintendent of the Southern New England company in 1910, vice-president and general manager in 1917 and was elected president last September.

Frank Conrad Receives Edison Medal

FRANK CONRAD, assistant chief engineer of the Westinghouse Electric & Manufacturing Company, has been made the recipient of the Edison medal of the American Institute of Electrical Engineers for his contribution to radio



broadcasting and short-wave radio transmission.

Dr. Frank Conrad was born in 1874 in Pittsburgh, Pa. In 1890 he entered the employ of the Westinghouse Electric & Manufacturing Company in Pittsburgh and his rise in the Westinghouse organization was rapid. He entered the laboratory after several years as an assistant in the shops. During this stage of his work he invented a number of forms of switches, lightning arresters and breakers for use in alternating-current work. He was closely associated with, and later in entire charge of, the arc lamp design department. This was his first engineering work.

Dr. Conrad's connection with radio dates back before the days of any broadcasting. He became interested as an amateur in radio reception of time signals and later in radio-telephone transmission by means of vacuum tubes. He established an amateur radio telephone station, which later resulted in the development of the Westinghouse Station, KDKA. Dr. Conrad was appointed a general engineer of the Westinghouse organization in 1904 and was promoted to the position of assistant chief engineer in 1921.

In 1925 he was awarded the Morris Liebmann memorial prize of the Institute of Radio Engineers for his early work in connection with high-frequency transmission. He is a fellow of the Institute of Radio Engineers, a member of the Society of Automotive Engineers and a member of the American Association for the Advancement of Science.

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Claxton E. Allen Named Westinghouse Vice-President

AT A RECENT MEETING of the board of directors of the Westinghouse Electric & Manufacturing Company Claxton E. Allen, formerly manager of the southwestern district, was elected commercial vice-president in charge of the domestic appliance division and other divisions serving the household market, such as refrigeration, radio, etc.

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G. D. HAWK, who has been connected with the Public Service Company of Northern Illinois for the past eight years, has been appointed supervisor of wiring sales.

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GEORGE O. MUHLFELD, vice-president of Stone & Webster, Inc., has been elected president, to succeed Edwin S. Webster, who has become vice-chairman of the board. HOWARD F. NEILL has been elected treasurer, to succeed Henry G. Bradlee, who will continue as vice-president.

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FRED P. STRONG, who for the past twenty years has been manager of the branch office of the Carolina Power & Light Company at Sanford, N. C., will be transferred to Hamlet, to take charge of the office there. Mr. Strong, who is a native of London, England, came to America 22 years ago. During his residence in Sanford he has taken an active part in the life of the community. Thomas Ector, manager of the Florence (S. C.) branch, will come to Sanford as manager of the local branch.

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GEORGE H. SANDER, industrial engineer of the Public Service Company of New Hampshire since 1927, has been appointed manager of the Manchester district to succeed Romie W. Wilson, whose death occurred November 29. Mr. Sander entered the employ of the Manchester Traction, Light & Power Company in 1909. His wide acquaintance and personal characteristics, in addition to his engineering training and years of experience in the company's affairs, make Mr. Sander well qualified to carry on the duties of his new position.

B. Gherardi Heads American Standards Association

ELECTION OF Bancroft Gherardi, vice-president and chief engineer of the American Telephone & Telegraph Company, to the presidency of the American Standards Association was announced at the annual meeting of the association at the Hotel Astor, New York, December 11. He succeeds William J. Serrill, who has held the office since 1928. Mr. Gherardi, who has been a member of the association's board of directors, will assume the direc-

tion of the national and international standardization activities of the organization, a task in which more than 2,000 representatives of about 500 national trade, technical and governmental bodies are engaged under American Standards Association auspices. Mr. Gherardi has been affiliated with the American Telephone & Telegraph Company since 1907 and has been vice-president and chief engineer since 1920. He is past-president of the American Institute of Electrical Engineers and has also served as president of the United Engineering Society.

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W. R. HERSTEIN, vice-president of the Armstrong Electric & Manufacturing Company, was unanimously chosen president of the Memphis Chamber of Commerce. Mr. Herstein is a prominent figure in the electrical field in the South. Following his election he appointed L. P. Brown, Jr., as chairman of the industrial division.

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HOWARD PETT, formerly district manager of the Consumers Power Company at Jackson, Mich., has been transferred to Lansing in the same capacity to succeed Clark R. Graves, who resigned after occupying that office for five years. Mr. Pett started with the organization 24 years ago in Big Rapids as local manager for the Grand Rapids-Muskegon Power Company. After the organization of the Consumers Power Company, he was transferred to Albion as local manager, and from there to Jackson as superintendent of electric distribution. In 1924, when J. K. Swanson was transferred to Saginaw, Mr. Pett was made manager of the Jackson district.

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IVAN L. SCOTT, who has been in charge of safety work for the National Electric Power Company, has transferred his offices from Asbury Park, N. J., to New York City.

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LIEUTENANT-COLONEL J. H. PRICE of Price Brothers & Company has been elected a director of the Quebec Power Company to succeed the late J. H. McCarthy.

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OBITUARY

ALLEN HUBBARD, member of the consulting engineering firm of French & Hubbard, died December 14 at Newton Hospital, Newton, Mass. A native of Westfield, Mass., and a graduate of Sheffield Scientific School, Yale, Mr. Hubbard had engaged in consulting engineering work with Mr. French since 1896, doing steam power work, hydro-electric and mill engineering, heating and ventilating. He was 70 years of age.

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EDMOND D. MCCARTHY, president of McCarthy Brothers & Ford of Buffalo, N. Y., died suddenly December 13 at the age of 58. He was for many years one of the most prominent electrical contractors and jobbers in the state, having been in the electrical business for more than 35 years. He founded the firm of McCarthy Brothers & Ford in 1892 and was also secretary of Beals, McCarthy & Rogers, Inc., wholesale steel and hardware merchants of Buffalo. He was very active in various organizations for the improvement of the electrical industry and was general chairman of the Electrical League of the Niagara Frontier, past-president of the Buffalo Electrical Contractors' Association, and a director in numerous companies, including the Marine Trust Company, the Iroquois Share Company and the Buffalo Chamber of Commerce. Mr. McCarthy was in the New York National Guard for many years, rising to the rank of major. He was a member of the American Institute of Electrical Engineers, the Engineering Society of Buffalo and numerous clubs.

Financial and Statistical News

FOLLOWING renewed liquidation this week, a representative group of fifteen power and light stocks listed on the New York Stock Exchange have settled back to 1926 prices and many in the group are below that level. These stocks now average twelve times earnings, which was the 1926 ratio, and four in the group had a ratio of less than ten times earnings before the sharp upturn.

——INABILITY OF COPPER PRODUCERS TO MAINTAIN PRICES induced renewed selling of the copper stocks. Anaconda, in particular, has been a target this week.

——UTILITY BONDS, ALONG WITH OTHER CORPORATE ISSUES, show renewed weakness as a result of switching by banks from corporate to government bonds and as a result of tax selling.

——ELECTRICAL MANUFACTURING STOCKS HAVE RESISTED the selling movement reasonably well. A favorable factor is the appearance of next year's utility budgets, which indicate a maintenance of the present volume of construction.

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Larger Denomination Bonds

BONDS ARE TO BE ISSUED in larger denominations for the convenience of the larger holders. The committee on relations with financial institutions of the National Electric Light Association decided last week that it would be better for utility companies to issue bonds in registered form for this purpose. This committee is headed by Charles B. Stuart of Halsey Stuart & Company, Inc.

It was proposed by the insurance companies recently that the utility companies should exchange without charge registered bonds for coupon bonds in the event that these large holders desire to sell part of their holdings. At present a charge is made for this service.

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Southern California Edison to Issue Bonds

AUTHORIZATION HAS BEEN given to the Southern California Edison Company, Ltd., by the California Railroad Commission to issue and sell on or before December 31, 1931, at not less than 95 per cent of face value, plus accrued interest, $5,000,000 of its refunding mortgage gold bonds, series 4½s, due 1955. Of the proceeds it has been authorized to use $4,037,700 to reimburse its treasury for moneys used to redeem the bonds of the Mount Whitney Power & Electric Company, of the Santa Barbara Electric Company and of the Edison Electric Company and to pay $660,700 of bonds of the Santa Barbara Electric Company. The remainder of the proceeds may be used to finance, in part, the cost of additions and betterments to the Southern California Edison Company's system, under the authorization.

The company intends to sell the bonds through its own organization. The bonds will be sold for cash and not on an installment payment basis.

German Merger May Need American Capital

AMALGAMATION OF OR A working arrangement between two of Germany's large utility systems, Rhine-Westphalia Electric Power Corporation and Westphalia United Electric Company, is being worked out. It is understood that a plan will be presented by the German interests through their representatives now en route to America, including Dr. W. F. Kehl, head of the Deutsche Bank and the Disconto-Gesellschaft.

Berlin dispatches indicate that the Rhine-Westphalia Electric Power Corporation will increase its common stock by 87,000,000 reichsmarks to 330,000,000 reichsmarks par value. It is understood that 40,000,000 of this addition is to be paid to the German municipalities and to the State of Prussia for their combined half interest in Westphalia United Electric Company.

The Rhine-Westphalia Electric Power Corporation was founded by Hugo Stinnes in his policy of unifying control of the supply of electric energy in the industrial area of western Germany. Westphalia United was formed by municipalities which opposed the Stinnes plan. The latter organization secured American capital recently through a banking group including Harris, Forbes & Company, hence the German mission to this country.

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Bank and Tax Selling Depresses Bond Market

SOME light is thrown on the current unsatisfactory condition of the bond market by Halsey, Stuart & Company in their quarterly review. There is no heavy supply of unsold bonds in the market, the review states. "Even the market situation surrounding the so-called investment type of issue is one that could readily be corrected by even a moderately sustained demand for bonds."

While there is no heavy supply of unsold bonds, as the volume of new issues has slackened during recent months, it is probable that a substantial volume of bonds sold some time ago have found their way back into the market. Heavy unloading has been reported on the part of New York City as well as outside banks. With the banking situation as it is, the banks must keep in as liquid a position as possible, hence the unloading of bonds. Selling of bonds likely to fall below the legal requirements for institutional investment, owing to reduced earnings, is also reported, as well as selling for tax purposes.

Discussing the happenings of the year, the review states that "the bond market of 1930 has been noteworthy for two principal reasons: First, for the ready reception that has been given to the so-called 'gilt-edge' variety; second, for the very limited interest shown in bonds of all other types, including scores of well-secured issues, whose only lack has been wide public recognition.

"This situation, of course, has reflected the prevailing state of the public mind. The uncertainty and excessive caution shown by investors during 1930 has been a natural reaction from the overconfidence and excessive enthusiasm of 1929. Most investors have not been satisfied to seek refuge in conservative bond investments, but have been insisting upon ultra-conservatism and extreme liquidity," says the quarterly review referred to. It continues:

"Public utility bond offerings during 1930 were larger than any year since 1927. The sustained demand for high-grade types of bonds of this class is a reflection of the remarkably good record which the public utility industry has been able to make this year in the face of depressed conditions."

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Further New Construction Programs Announced

SEVERAL new construction programs for 1931 have been announced during the week. These include Standard Gas & Electric Company, New England Power Association, Tennessee Electric Power Company, Narragansett Electric Company, etc., and total well over $63,000,000.

Of this total, Standard Gas & Electric Company will spend $43,596,257. The company's construction program included in this amount provides for an additional generating unit of 35,000 kw. capacity to be built at the Riverside plant of the Northern States Power Company in Minneapolis, a hydro-electric station of 40,000 kw. capacity to be built for the California Oregon Power Company and two transmission lines connecting the Minnesota Valley steam plant at Granite Falls, Minn., with other parts of the Northern States Power Company system. During 1930, according to Mr. O'Brien, five major electrical projects of an engineering nature were practically completed, adding 125,500 kw. to the system and bringing the total installed steam and hydro-electric generating capacity in the Standard system to 1,521,203 kw.

Large projects in South

Expenditures totaling $4,500,000 will be made by the Tennessee Electric Power Company starting during 1931, according to an announcement by J. C. Guild, Jr., vice-president and general manager.

Of this amount $870,000 will be spent for improvement in the Nashville area, $611,000 to be spent for light and power departments and the balance, nearly $260,000, for improvements of the railway facilities.

One project in Nashville will cost $100,000. Erection of an outdoor central substation, adjoining the company's steam-electric generating plant, will make available for the downtown district the large power capacity of the substations in West and South Nashville.

The Narragansett Electric Company, Providence, R. I., according to President Roy F. Whitney, will spend $3,000,000 on construction work during 1931. The South County Public Service Company, the Attleboro (Mass.) Steam & Electric Company, the Fall River (Mass.) Electric Light Company, adjoining units of the New England Power Association, will spend a total of $1,000,000.

New England Power Association will spend $12,000,000 in 1931 for construction, extensions and additions, according to President Frank D. Comerford. Construction which normally might be deferred is being expedited, Mr. Comerford said.

Detroit Edison rushes projects

Some of the projects involved in the $13,000,000 budget of the Detroit Edison Company, already announced, follow:

The company will continue work on the construction of a new switch house at the Connors Creek power plant. The purpose of this switch house is to control all of the electricity generated at the plant and to switch the high-tension current to the many substations in Detroit, from which it is distributed to the consumers. This is such a large job that it will not be completed until some time in 1932. The new switch house and the plant control house are to replace the present switch house, which has become both obsolete and inadequate.

At the Delray power house No. 3 an additional 67,000-hp. turbo-generator will be delivered about July, but this machine will probably not be ready for service until some time in 1932. This will be the third turbine of this kind for the Delray plant and the company has seven more identical units at Trenton Channel and Marysville plants. A new 13,000-hp. high temperature turbo-generator and its auxiliaries is now being installed at Delray power house No. 3.

NEW CAPITAL ISSUES

During the week ended December 18 the Virginia Public Service Company made an offering of first mortgage and refunding twenty-year 5 per cent gold bonds, series B, to the amount of $6,000,000, the price being 90 and interest, to yield over 5.85 per cent. Proceeds will be used to reimburse the treasury for recent additions and betterments to the properties and for other corporate purposes.

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West Texas Utilities Company issued first mortgage 5 per cent gold bonds, series A, totaling $3,750,000, at 89¾ and interest, yielding about 5¾ per cent. Proceeds will be used partially to reimburse the company's treasury for the costs of extensions and additions to its properties. These securities mature October 1, 1957.

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Italian Power Develops Without Foreign Capital

AMERICAN CAPITAL is not currently needed for Italy's electrical construction and development program, Count Guiseppe Volpi stated before he returned home after a short unofficial visit to this country. Count Volpi is chairman of Italy's largest utility group, including Adriatica Electric Company, European Electric Corporation, Italian-Belgian Electric & Public Utility Company, etc.

Count Volpi stated that the rapid development of electrical energy, especially the rationalization of the national wealth in water power, had done much to foster industrial progress in general. The capacity of installed hydro-electric plants in Italy at the end of 1929 was about 4,250,000 hp. The capacity of steam stations was over 800,000 hp. Output of electricity last calendar year was over 11,000,000,000 kw.-hr., and the equipment in use in Italy is thoroughly modern, Count Volpi said.

Demand for electrical energy in Italy has expanded very rapidly and continues to do so despite current industrial depression throughout the world. Distribution is being extended steadily to the smaller communities. For the first half of 1930 electrical output was 14 per cent greater than for the first half of 1929.

Rumors have been current that Count Volpi had sought to interest the State Department at Washington in granting a credit of $150,000,000 to Italy as a preliminary step to the flotation of a bond issue, but had received little encouragement.

Industrial Index Shows Textile Rise

A RISE of 2 per cent from October brings the November index of general industrial activity back within 5 per cent of the September figure. The index is computed from monthly reports, directly to the ELECTRICAL WORLD, of energy used by some 3,800 manufacturing plants. The change is scarcely large enough or general enough to be highly significant. The more important gains were in textiles, forest products, metal working, the stone, clay and glass group, chemicals, and shipbuilding. Downward changes are indicated in steel making and fabricating, leather, paper and pulp, food products, automobiles, parts and accessories.

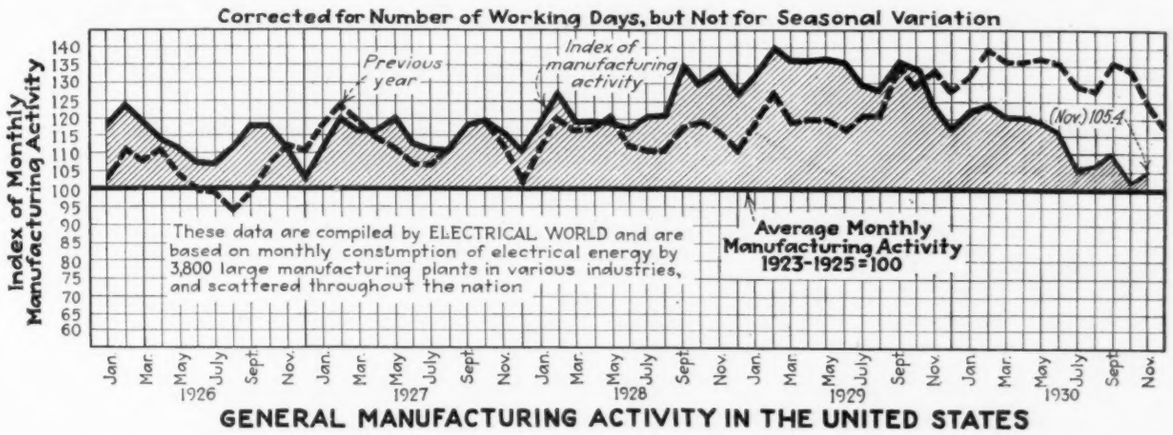
In numerous industrial groups the changes, both up and down, were merely a return to quite recent levels. Thus for steel and iron, metal working, leather and its products, the stone-clay-glass group, chemicals, the November index is within a few points of that for September. But textiles have moved distinctly upward, while forest products, paper, rubber, food and automobiles are lower than in September. In part the decline is seasonal. Compared with 1929 the showing is more favorable than last month. The all-industry index for the month of October was down 23 per cent; for the month of November only 14 per cent.

The regional indices for the industrial East have risen materially since midsummer, while in the Central States the changes have been slight. Textiles, however, moved upward in the Central as in all other groups of states where this industry is prominent.

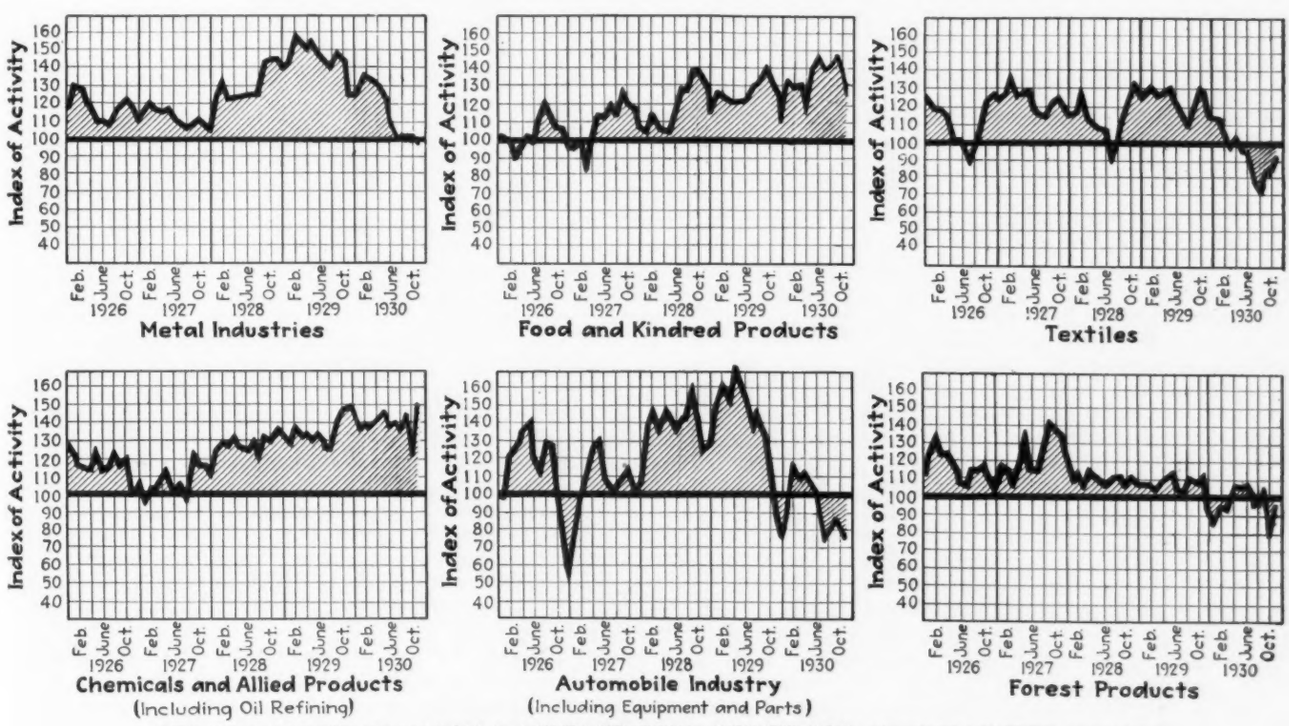
Current Manufacturing Compared With Other Periods

Per Cent Change

Industrial Group	Nov., 1930 and Oct., 1930	Nov., 1930 and Nov., 1929	First 11 Months of 1930 and of 1929
All industry	+ 2.1	—14.3	—14.9
Chemical products (including oil refining)	+22.9	+ 2.2	+ 3.7
Food products	— 8.7	— 2.0	+ 5.7
Iron and steel plants	—12.9	—11.0	—17.5
Metal working	+ 7.4	—27.4	—23.5
Leather products	—18.7	—29.3	—11.5
Forest products	+23.7	—14.7	—12.5
Paper and pulp	—15.0	—23.5	— 5.3
Rubber products	— 4.2	—12.5	—13.7
Shipbuilding	+ 5.2	+16.4	+10.8
Stone, clay and glass	+12.5	—18.3	—20.5
Textiles	+ 9.4	—18.5	—24.2
Automobiles (including parts and accessories)	— 7.4	—15.3	—34.7


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
(Nov.) 105.4
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

National Electric Power Boosts Appliance Sales

A GAIN OF 23.8 per cent in October sales of load-building appliances by subsidiaries in fifteen Eastern states has been reported by the National Electric Power Company, a part of the Middle West Utilities System.

Total sales in October, 1930, were $592,850, as against $479,062 in October, 1929, an increase of $113,788. For the first ten months of 1930 appliance sales totaled $5,532,676, an increase of 16.5 per cent over sales at October 31, 1930, when the total was $4,747,047.

Increased use of electric appliances caused total kilowatt-hour sales to residential customers in the first ten months to increase 15.5 per cent over the same period in 1929. By augmenting the smaller gain of 5.2 per cent in sales to commercial power customers, this residential increase has kept total energy sales to customers of all classes 7.9 per cent ahead of the first nine months a year ago. Total electric revenue for this period showed a corresponding increase of 7 per cent.

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Radio Talks on Methods of Stabilizing Employment

A SERIES OF NATION-WIDE radio presentations of methods used by representative industries to stabilize employment began December 16 under the auspices of the President's Emergency Committee for Employment, Col. Arthur Woods, chairman of the committee, announced.

Important industrialists and employers who will discuss plans their companies are using to protect workers against unemployment, in addition to Gerard Swope, president General Electric Company, are Cyrus McCormick, vice-president of the International Harvester Company, and Walter Teagle, president of the Standard Oil Company of New Jersey.

"The purpose of the series," said Colonel Woods in announcing the speakers, "is to make available to employers the knowledge of what some industries have done and are doing either to prevent or reduce unemployment."

In his address this week Mr. Swope outlined the complete program of the General Electric Company with relation to unemployment and employee welfare. Under a free group insurance plan offered by the company in 1919, Mr. Swope said, $6,500,000 has been paid to families of deceased employees. In the past seven years, under a home ownership plan inaugurated by the company, 2,500 homes, worth $19,000,000, have been acquired by General Electric's employees. For the "inevitable rainy day," Mr. Swope declared, a plan was developed under which about 36,000 employees now hold bonds with a total value of $41,000,000.

Under a pension plan put into effect by the company, nearly $4,000,000 has been paid in pensions to retiring employees, about 1,000 being on the company's pension rolls at present.

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Department of Commerce Makes Domestic Range Study

A SURVEY of sales and stocks of ranges used for home cooking has been made by the Department of Commerce, according to Marshall T. Jones, chief of the electrical equipment division of the department. Trends in styles of ranges used for home cooking, with special reference to the domestic application of electrical appliances, will be determined through this survey, details of which will be released shortly.

If the problem of installation of ranges can be met, Mr. Jones said, exploitation of the cooking market by the electrical industry can be accelerated. Manufacturers of cooking appliances believe that the electric range would find greater use if the utilities would share in the cost of installing the equipment. High installation cost, the trade believes, is retarding the growth of the electric range, it is stated. The cost of special wiring to handle the higher load required by the electric stove is the major factor in the situation and the trade is looking to the utilities to absorb this expense if they would have the extra power business.

In a few cases power companies pay for electric range installation, but this is confined largely to utilities which sell ranges through their merchandising departments. The manufacturers of appliances feel that the cost should be part of service expenses, inasmuch as they increase the revenue return and should therefore be paid out of expansion funds. The return from such an investment is illustrated by the published record of one company which shows that an additional investment of $45 in range installation per new customer would result in an additional $44 annually in revenue.

The appliance industry points to the fact that more than twice as many wired homes have electric refrigerators as have electric ranges, despite the more recent introduction of the refrigerator. Reduced range rates are offered by companies serving more than 8,000,000 homes, every one of which is a potential purchaser, but only 158,000 ranges were sold last year.

Surveying the field of cooking in America, it is found by the investigation that less than half of the nation's homes cook by gas, that slightly more than a fourth use coal and wood, that nearly half as many as those who use gas do their cooking by oil, while less than one million families cook by electricity.

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Circuit Breaker Control for Steel Plant

THE CARNEGIE STEEL COMPANY has recently placed a contract with the Westinghouse Electric & Manufacturing Company amounting to approximately $140,000 covering a 1,600-volt, 60-120-r.p.m. reversing induction motor, a 1,250-kw. synchronous motor-generator and complete switching equipment for use in its Duquesne works.

The contract includes switching and relay equipments which will be used in extending the plant power system to take care of future improvements. The equipment will be provided for installing a balanced pilot wire relay system for controlling various oil circuit breakers throughout the plant. It is believed that this is the first installation of this system of circuit breaker control in an industrial plant.

TRADE BRIEFS

Illinois Stoker Company, Alton, Ill., has opened a new office in New York City under Alex Girtanner.

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Edison General Electric Appliance Company, Chicago, elected Ray W. Turnbull, now Pacific Coast district sales manager, as vice-president.

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Weber Electric Company, Schenectady, N. Y., will consolidate its manufacturing and selling activities, effective January 1, 1931, the latter having been carried on for the past 30 years by Henry D. Sears as general sales agent.

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The following changes in the sales personnel of the Federal Steel Products Company have been made: G. A. Milius will cover the territory of New Jersey; R. D. Steinberg will be the New York district manager and Charles Shelburn will be associated with him; L. A. Weiller has been engaged to cover Maryland and the District of Columbia.

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Westinghouse Electric Supply Buys Stanley & Patterson

THE ELECTRICAL SUPPLY distributing business of Stanley & Patterson, Inc., whose sales amount to more than $5,000,000 annually in the metropolitan district, will be purchased by the Westinghouse Electric Supply Company, distributing subsidiary of Westinghouse Electric & Manufacturing Company.

The purchase will be confined to the distributing organization of Stanley & Patterson. The signal and radio manufacturing branches of the business are not included in the sale. George Patterson, president and principal stockholder of Stanley & Patterson, will retain control of the company, while a new company, the Stanley & Patterson Electric Supply Company, will be formed by Westinghouse.

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Copper Price Lower But Sentiment Is Good

THE COPPER MARKET continues to be in the hands of the group that is popularly or unpopularly known as the custom smelters; the large producers are out of the market at current levels. Though there is not very much copper pressing for sale from day to day, it is more than ample to take care of consuming demand.

	Dec. 10, 1930 Cents per Pound	Dec. 17, 1930 Cents per Pound
Copper, electrolytic	10½–11	10
Lead, Am. S. & R. price	5.10	5.10
Antimony	7.10	7.10
Nickel, ingot	35	35
Zinc, spots	4.15–4.20	4.35
Tin, straits	25.10	23¾
Aluminum, 99 per cent.	23.30	23.30

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EXPORTS OF ELECTRICAL EQUIPMENT (PRELIMINARY)

Article	October 1929	October 1930
Generators:		
Direct current—		
Under 500 kw.	113,518	38,884
500 kw. and over	97,279	.....
Alternating current—		
Under 2,000 kva.	16,087	10,277
2,000 kva. and over	7,091	14,796
Steam turbine generator sets	168,814	53,370
Accessories and parts for generators	82,720	38,008
Arc welding sets	.....	55,591
Self-contained lighting outfits	139,746	57,558
Batteries:		
Storage batteries	301,245	.....
6-volt storage batteries	.....	180,878
Other storage batteries	.....	104,786
No. 6 dry cell batteries	.....	34,862
Flashlight batteries	314,135	402,895
Radio B and C batteries (dry)	76,141	33,354
Other dry and wet cell primary batteries	146,084	12,732
Transforming or converting apparatus:		
Power transformers, 500 kva. and over	87,074	18,117
Distribution transformers, less than 500 kva.	186,676	62,054
Instrument transformers	20,912	24,311
Other transformers	135,621	58,021
Complete battery chargers under 15 amperes	19,752	12,597
Rectifiers, double current and motor generators, dynamotors, synchronous, and other converters	142,204	85,353
Transmission and distribution apparatus:		
Switchboard panels, except telephone	114,554	135,368
Switches and circuit breakers over 10 amp.	210,360	146,453
Fuses	51,975	27,232
Watt-hour and other measuring meters	116,027	49,858
Electrical indicating instruments	55,829	64,433
Electrical recording instruments	27,324	32,961
Other electrical testing apparatus	83,617	112,805
Lightning arresters, choke coils, reactors and other protective devices	111,523	43,323
Motors, starters and controllers:		
Motors, ¼ hp. and under 1 hp	243,676	182,457
Motors, over ¼ and under 1 hp	57,236	59,588
Stationary motors—		
1 to 200 hp.	311,945	233,419
Over 200 hp.	40,702	58,669
Railway motors	3,558	36,389
Electric locomotives—		
Railway	21,164	48,049
Mining and industrial	77,696	40,356
Station and warehouse electric motor trucks	42,569	.....
Starting and controlling equipment—		
For industrial motors	173,834	126,137
For electric railway and vehicle motors	10,670	10,751
Portable electric tools	97,415	82,055
Accessories and parts for motors	376,979	156,466
Refrigeration sets up to ½-ton capacity	810,759	.....
Refrigeration sets over ½ to 1 ton capacity	88,675	.....
Electric household refrigerators	.....	396,139
Electric commercial refrigerators up to 1 ton	.....	118,666
Thermodynamic refrigerators	.....	171
Electric appliances:		
Electric fans	120,104	37,495
Electromechanical health exercisers	.....	9,268
Electric incandescent light bulbs—		
Metal filament	137,422	.....
For automobiles, flashlights, and Christmas trees	.....	21,361
Other metal filament bulbs	.....	72,477
Other electric lamp bulbs	65,495	10,427
Flashlight cases	215,541	100,981
Searchlights and floodlights	75,981	60,747
Motor-driven household devices—		
Electric household washing machines	238,496	109,886
Electric vacuum cleaners	175,700	179,149
Other motor-driven devices, except tools	83,221	62,472
Electric flatirons	28,377	15,870
Electric cooking ranges	28,330	67,888
Other domestic heating and cooking devices	105,975	109,006
Industrial electric furnaces and ovens	40,657	127,846
Therapeutic and x-ray apparatus	190,549	156,768
Signal and communication devices:		
Radio apparatus—		
Transmitting tubes, sets and parts	135,973	71,807
Receiving sets	1,568,390	1,357,424
Radio receiving tubes	219,712	175,128
Receiving-set components	867,671	601,862
Loudspeakers	341,743	139,958
Other receiving-set accessories	584,499	371,251
Telegraph apparatus	117,690	36,384
Telephone apparatus—		
Telephone instruments	124,943	54,222
Telephone switchboards	90,272	10,162
Other telephone equipment	395,571	269,777
Bells, buzzers, annunciators and alarms	39,841	41,307
Other electric apparatus:		
Spark plugs	105,806	69,790
Other starting, lighting and ignition equipment	203,506	100,794
Insulating material	132,158	59,978
Metal conduit, outlet, and switch boxes	135,892	102,764
Sockets, outlets, fuse blocks and lighting switches	164,802	160,229
Electric interior lighting fixtures	229,639	207,391
Electric street lighting fixtures	53,128	40,017
Other wiring supplies and line material	123,473	147,186
Other electrical apparatus, n. e. s.	1,207,561	708,380
Rubber and friction tape	32,086	27,881
Globes and shades for lighting fixtures	76,851	48,020
Glass electric insulators	37,681	22,941
Electrical porcelain:		
For less than 6,600 volts	112,154	27,950
For 6,600 volts and over	103,643	48,281
Carbons and electrodes:		
Electrodes for electric furnaces	202,452	152,927
Other carbon products	64,657	43,657
Insulated iron or steel wire and cable	22,619	13,226
Copper, bare wire	193,464	70,068
Insulated copper wire and cable	470,552	.....
Rubber covered wire	.....	40,910
Weatherproof wire	.....	27,852
Telephone cable	.....	21,464
Other insulated copper wire	.....	239,444
Totals	$14,847,454	$10,117,262
Ten months ended Oct. 31	$123,441,703	$110,713,326

Market Conditions

BOTH industrial and domestic buying of electrical products on the Pacific Coast have dropped sharply and prospective business is light. Christmas buying is reported to be relatively the smallest on record, while power company and industrial orders are unusually small.

——INQUIRIES AS WELL AS ORDERS HAVE DECLINED RADICALLY in the Eastern market as well, and volume of business for the balance of the year is expected to be small.

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PACIFIC COAST

—THE RECENT MARKET DROP *seems to have prematurely chilled the buying and dealers report the relatively poorest Christmas buying in their history. Cheaper toasters, waffle irons, percolators and kitchen mixers are moving best in the appliances, also radios in the highest and lowest price ranges, and there is a spotty demand for washers and vacuum cleaners.*

—INDUSTRIAL BUYING *is very poor, with not even sizable maintenance or repair orders to report or in prospect. Power company business for this week is confined to about five assorted carloads of poles, hardware and pins.*

An $80,000 paper and lead wire order for southern California is pending. Employment relief projects are mainly limited to labor, but include a proposed $5,000,000 civic center unit for Fresno. The outstanding order for the past week covers $35,000 worth of Westinghouse switching equipment for a steel plant in San Francisco Bay area. The outstanding project is the $28,000,000 proposed budget of the Southern California Edison Company for 1931, of which nearly half covers a 135,000-hp. steam turbine plant at Long Beach. Government business includes $4,000 worth of rubber-covered and weatherproof wire for San Francisco, rewiring the hospital in San Francisco, a proposed $3,000,000 expenditure for veterans' homes and hospitals in San Fernando and Sawtelle and a projected $10,000,000 expenditure for new Los Angeles post office and various federal buildings in southern California.

Sales of motors and apparatus last week are reported by Seattle jobbers to be at absolute minimum, the movement including only fifteen machines from 100 hp. down to dealers, eight from 50 hp. down to a lumber mill in Oregon, about twenty from 50 hp. down to scattered industrials and 40 transformers from 3 to 7½ kva. to a Puget Sound central station. Seattle purchasing department bought a 100-hp. electric hoist, 1,500 eucalyptus wood pins and 500 10-ft., four-pin crossarms. Howard Flat irrigation district, Chelan, Wash., opened bids for two 700-hp. and one 50-hp. motor-driven centrifugal pumps. Bids for furnishing copper conductor wire for a high-tension transmission line from Diablo project to the city of Seattle, estimated to cost about $800,000, are expected to be taken by Board of Public Works within 30 days. The wire will total about 740 miles, comprising two three-wire circuits. Bids for steel towers, costing about $1,700,000, are expected to be taken in the spring. Pacific Telephone & Telegraph Company announces expenditure of $5,000,000 in Washington and Idaho during 1931 in line construction, equipment, etc. Board of Contracts and Awards, Tacoma, will open bids December 22 for 40,000 lb. of copper transmission wire.

CONSTRUCTION PROJECTS

East Bay Municipal Utility District, Oakland, Calif., made application for permission to develop nydro-electric power project on Mokelumne River, reported to cost over $1,000,000. California Institute of Technology, Pasadena, Calif., plans new college units, to cost $1,000,000. Southern California Edison Company, Los Angeles, Calif., plans submarine cable lines at Long Beach, Calif. City Lighting Company, Seattle, Wash., has filed plans for plant building on Third Avenue, to cost $2,000,000. Bureau of Reclamation, Denver, Colo., will receive bids until December 26 for gates and hoists for Minidoka project, Idaho (Specification 497-D).

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SOUTHWEST

—VERY LITTLE CHANGE *has been reported since last week's report. There has been the usual number of small orders, but the aggregate is considerably below normal for the season.*

Jobbers report a number of last-minute orders for holiday type of electrical appliances. Missouri State Department has placed orders with some of the large manufacturers for electrical apparatus and supplies amounting to about $60,000.

CONSTRUCTION PROJECTS

Missouri-Pacific Railway Company, St. Louis, Mo., will soon take bids for a grain elevator to cost $1,000,000. Missouri Portland Cement Company, St. Louis, Mo., has plans for cement mill at Tulsa, Okla., reported to cost about $400,000. St. Joseph Railway, Light & Power Company, St. Joseph, Mo., will make extensions in equipment storage and distributing plant to cost $50,000. Dayson Petroleum Company, Smackover, Ark., contemplates oil refinery to cost $125,000. Texas Technological College, Lubbock, Tex., plans power plant addition.

MIDDLE WEST

—NOT MUCH CHANGE *in general business is noticeable this week in the Middle West section. Most lines of industry are quietly marking time, with the expectation that the turn of the year will produce a demand for larger quantities of merchandise and materials.*

—MANY FIRMS ARE TAKING *inventory and inasmuch as inventories are generally low, it seems reasonable to expect that larger replacements will be necessary.*

Major activities are maintaining their positions, with some improvement noticeable in the automotive industry. Preliminary reports of the railroads indicate some substantial expenditures for maintenance work next year and the various utility companies are preparing to spend a sizable amount of money in new construction and line extension work. The retail stores are enjoying a considerable amount of holiday purchasing and, contrary to expectations, indications seem to point to a very satisfactory Christmas period. Some of the interesting orders placed this week include 200,000 lb. of condenser tubes, 150 10-kva., 75 15-kva., 25 37½-kva., 25 75-kva., 25 100-kva., and six 200-kva. pole-type, single-phase distribution transformers.

CONSTRUCTION PROJECTS

Tigerton Electric Company, Tigerton, Wis., plans transmission line at Shawano, Wis., and vicinity. H. Peter Henschien, 1637 Prairie Avenue, Chicago, Ill., architect and engineer, has been engaged by the Soviet Russian government to prepare plans for a group of meat packing plants in Russia, to cost $20,000,000. Western Public Service Company, Scottsbluff, Neb., plans power plant at Orleans, Neb., to cost $100,000. Interstate Power Company, Dubuque, Iowa, plans power substation at Wynot, Neb. Iowa Light & Power Company, Des Moines, Iowa, plans extensions and improvements in power plants and transmission lines to cost $700,000. Fort Dodge Gas & Electric Company, Fort Dodge, Iowa, has approved plans for extensions in power plant to cost $200,000.

EASTERN

—WITH A FEW EXCEPTIONS, *sizable awards continue in the minority in the Eastern electrical equipment market and the holiday season just ahead carries indications of being extremely quiet. Inquiries have declined during the past week and present buying is distinctly for immediate needs.*

—INDUSTRIAL ACCOUNT *shows up better than central station business at the moment, and the turn of the year is expected to show a further broadening in demand for motors and allied equipment, with iron and steel, paper, textile and other basic industries trending to improved operations; an important commitment has been placed for steel mill electrification. Central-station purchases continue to be restricted to substation and line work.*

The Union Electric Light & Power Company, St. Louis, has placed a large award for insulators with the Lapp Insulator Company, LeRoy, N. Y., totaling about $300,000; it is the largest single order ever received by the company, calling for close to 40 carloads of porcelain insulators delivered during the next six months, and bringing a capacity schedule at the Lapp plant. A metropolitan central station has placed an order with a state manufacturer for transformers to an amount of $30,000. A municipality in Minnesota has given an order for a Diesel engine-generating set for municipal service, as well as an award for distributing lines. A similar commitment has been made by a Wisconsin city for a municipal-owned station costing close to $75,000.

The Westinghouse Electric & Manufacturing Company reports a contract from the Carnegie Steel Company, a subsidiary of the United States Steel Corporation, for the electrification of its Duquesne Works, near Pittsburgh, the installation to include one 1,600-hp. induction motor, one 1,250-hp. unit of like type, switching apparatus, automatic electrical control equipment and other accessories. The award calls for completion in the spring. There is other business of this character looming ahead for early assignment, and both steel and iron account offers one of the most encouraging prospects in the industrial field. A manufacturer of electric washing machines in northern New York has purchased a quantity of fractional-horsepower motors from a state maker, totaling about $65,000. Another producer of washing machines in the Middle West has begun to market a low-priced unit, to retail under $100, and will develop capacity manufacture for this account.

Oil pipe line construction is bringing some heavy commitments for different branches of operation. The Phillips Pipe Line Company, Bartlesville, Okla., has purchased equipment for a group of seven booster stations from the Westinghouse Electric & Manufacturing Company, including 21 sets of step-up gears; the line will have a maximum capacity of 30,000 bbl. of gasoline per day and is designed for a total of fifteen booster stations for that output. Electric lighting equipment for airport and airway service is engaging under increased call and several important contracts are scheduled for early award.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until January 13 for main propelling machinery, with auxiliaries and spare parts (Schedule 4724). New York Central Railroad, Buffalo, N. Y., plans public market and terminal to cost $1,200,000. Edison Electric Appliance Company, New York, contemplates an addition to plant at Waynesboro, Va. New Jersey Port Commission, Camden, N. J., plans terminal building on Delaware River, to cost $500,000. Anheuser-Busch, St. Louis, Mo., has plans maturing for yeast plant, near Old Bridge, N. J., to cost $1,500,000. Treasury Department, office of Supervising Architect, will receive bids until December 30 for a Federal Penitentiary at Louisville, Pa., to cost $3,000,000. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until January 2 for copper-clad wire, motor, electric grills, air compressor and other electrical supplies (Panama Schedule 2617). Department of Commerce, Washington, D. C., will receive bids until December 29 for lighting facilities on San Diego-Los Angeles airway, including electric revolving beacons, etc. (Proposal 22777.)

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SOUTHEAST

—THE DEMAND FOR *heavy equipment seems to have dried up, but jobbers report a good holiday trade. Heating appliances and electric clocks are in very satisfactory demand.*

Christmas tree lighting is showing a brisk activity, one jobber stating his sales of Christmas tree sets will exceed $20,000 this year, as compared to only $10,000 last year. Some transformer orders last week were for two 2,000-kva., 19,000-volt and three 100-kva. transformers in Georgia and an $8,000 order from Tennessee for this equipment. An order approximating $18,000 for distribution transformers is pending in Georgia and may be let this week. One company's meter orders last week aggregated $5,680, while its creosoted pine pole orders totaled $4,100. Some other central-station orders were for $5,000 worth of car wheels and $4,260 of signs. Three circuit breaker orders, approximating $30,000, are pending in Georgia and Alabama and will probably be let during the next week or ten days. Electrical materials amounting to about $30,000 were ordered last week in connection with the changeover from direct to alternating current service by a publishing company in Atlanta. Electrical materials amounting to approximately $7,000 will be ordered within the next two weeks on an office building job in Atlanta, with about $20,000 additional to be placed within the next few months.

CONSTRUCTION PROJECTS

Chesapeake & Ohio Railway Company, Richmond, Va., will build an addition to engine house and shops at Handley, W. Va., to cost about $60,000. Ford Hardwood Lumber Mills, Memphis, Tenn., contemplate plant to cost over $100,000. Montgomery, Ala., plans additions to municipal airport, reported to cost about $100,000. Chevrolet Motor Company, Detroit, Mich., plans automobile body plant at Jacksonville, Fla., to cost $125,000.

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NEW ENGLAND

—DURING THE PAST WEEK *in this district electrical machinery orders were confined to small motors, which are in fair demand. Switch and control equipment is moving fairly well, but buying is confined generally to a day-by-day plan. Inquiries for heavy machinery are encouraging, according to one manufacturer, and information concerning electric heating furnaces is being asked.*

—CENTRAL-STATION SUPPLIES *are receiving very little attention, although some optimism for improved business is widespread on account of expensive line extensions recently announced by prominent power companies in this district.*

According to one well-known distributor counter sales, including wiring devices, house appliances and special lighting requirements, for this year compare favorably with last year. Merchandising as reported by one group of central stations to date shows a volume of sales slightly in excess of those of last year. New construction in this district which will require considerable electrical equipment includes subway extensions for the city of Boston and service line extensions on a large scale throughout Massachusetts.

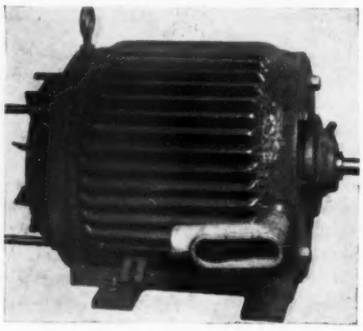
CONSTRUCTION PROJECTS

Massachusetts Institute of Technology, Cambridge, Mass., has filed plans for a physics and chemistry laboratory to cost $700,000. American Smokeless Powder Company, Acton, Mass., contemplates plant to cost about $50,000. New England Electric Company, Hartford, Conn., has approved plans for an equipment storage, service and distributing building, reported to cost about $85,000. Economy Umbrella Manufacturing Company, Boston, Mass., contemplates plant improvements to cost $50,000.

New Equipment Available

Totally Inclosed, Fan-Cooled Induction Motor

A TOTALLY INCLOSED, double fan-cooled induction motor which embodies new and unusual features has recently been announced by the Lincoln Electric Company, Cleveland, Ohio. The design of this motor includes arc-welded steel con-



struction, double sealed ball bearings and a removable cover, which facilitates easy cleaning of the unusually large radiating surface. The large radiating surface is obtained by complete inclosure of sides of the motor with a deeply corrugated sheet of corrosion-resisting metal, which in turn is covered by a removable shell.

The air imprisoned within the completely sealed frame is constantly circulated by a fan arc welded to the rotor. This fan drives the heated air within the motor to continuous contact with the large corrugated cooling surface. The outside air which carries the heat from the radiating surface is forced over the exterior of the corrugated surface by a large arc-welded fan attached to the motor shaft. The outside air is drawn in at one end of the motor and expelled at the other end.

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Automatic Control for Industrial Ovens

POSITIVE AUTOMATIC CONTROL apparatus for industrial furnaces which is said to combine temperature requirements with oven safety is announced by the Paul Maehler Company, Chicago, Ill. This control unit is claimed to embody in one compact unit the functions of the numerous individual control devices heretofore used in connection with oven operation.

The device consists of a main switch, fuses, temperature-control valve, an automatic mercury actuator, a gas-pressure controller, high-voltage transformer, time control, and red and green flasher lights which indicate the operation at all times.

Adjustable arms provide the maximum and minimum ranges, and when contact is formed with the temperature indicating arms the electrically operated temperature control valve closes or opens automatically, thus retarding or increasing the fuel supply in the oven. On the heater itself is located an automatic shut-off safety valve which, in the event of either fan or fuel failure, automatically shuts off the fuel supply.

The total electrical input to the control unit is 175 watts, with only 75 watts being used continuously.

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Portable Ohmmeter for Circuit Resistance

A NEWLY DESIGNED low price portable ohmmeter for measuring circuit resistances and continuity is announced by the Weston Electrical Instrument Corporation, Newark, N. J., under the trade name "Model 563 D.C. Circuit Tester."

The two ranges of the instrument,

0-50,000 and 0-5,000 ohms, permit an unusually wide scope of measurements; thus this one instrument serves for practically all resistance testing usually encountered. Model 563 is a high sensitivity instrument, hence the drain on the self-contained 1.5-volt dry cell is exceedingly slight—on the high range only 1 milliampere and on the low range 10 milliamperes. On the high range the life of the cell is therefore practically its "shelf" life and assures long service before necessity of replacement.

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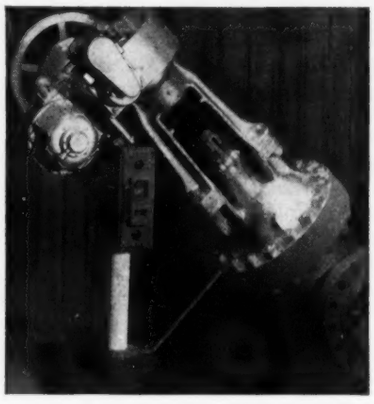
Telephone-Controlled Valve for Power Plant Safety

EMERGENCY OR SERVICE OPERATION of large steam line valves, without the expense of control equipment ordinarily involved in centralized supervision, is claimed by the Limitorque Corporation,



through the operation of telephone control. It is now possible to open and close large motor-operated valves by telephone, it is stated. By dialing the number of the valve telephone in the ordinary way, instead of receiving the usual "Hello," a click or buzz is heard, and in response to that, one merely speaks the 'close" into the transmitter and the valve automatically closes. In brief, it is now possible to adjust these large valves by the human voice.

The mechanism is tuned to respond to three particular sounds as produced by a special whistle, so that after the valve is closed the word "open" is sounded, to which the valve responds and opens. In response to an additional third tone whistle the valve is made to stop. The device is operated over any outside or intercommunication system, and a group of 100 or more of these large valves may be operated from a small telephone switchboard such as is used for ordinary business service.

The system is applicable to almost any power-driven apparatus, such as large sluicegates in hydro-electric systems, reservoir gates that may be operated over long-distance lines to shut in case of flood or to vary the flow of water.